

311 Stanford Avenue
Menlo Park, CA 94025
June 10th, 1981

Mr. Paul L. Rinaldo
1524 Springvale Avenue
McLean, Virginia 22101

Dear Paul,

Thanks very much for your report on your meeting with the DARPA people, and for the information you sent on the INTERNET protocol, TCP and the packet radio article. I think the INTERNET specification deserves some serious discussion by our group, and the purpose of this letter is to review some of the merits of this standard and how it could be used as the basis of our experimental network.

First, the INTERNET protocol standard is based on the concept of a network which uses a "datagram" as the basic unit of exchange, the basic commodity which is transmitted through a net or between nets. Datagrams are nothing more than packets which have a source and destination address embedded in them and some other control information. The delivery of datagrams through a net is not guaranteed, but is done on a best effort basis. It is the responsibility of the end-to-end communicating processes to check that all outstanding datagrams have been received and correctly ordered, and these processes must be prepared for lost or duplicate datagrams. Much has been written in the literature about datagrams and how they form the fundamental building blocks of networks, and I won't repeat all the arguments here. Let me simply state that many current large scale networks have been built using the datagram concept, and we should not overlook this approach in our design.

About a year ago when I was studying the design of the AMSAT AMICON system, the INTERNET spec first came to my attention. My conclusion then, as you can tell from the first AMICON draft, was that a datagram approach was right for that system. I now would argue that it is also right for our terrestrial networks as well.

Recently I had several long discussions with two people who are professionally involved with computer networking and who are radio amateurs as well. One of these persons is Dave Boggs of Xerox, co-inventor of the Ethernet. Dave described to me how the corporate Ethernet is really a heterogeneous network of Xerox Alto and other types of computers, with links in the network going up and down on a daily basis, with constant changes of equipment and configurations, and with some of the network nodes left on continuously and with some nodes only running 9 to 5 or as needed. Thus, their environment is not drastically different from what we would expect to see in the amateur community, where stations come and go and where elements of the network may be

very reliable or very flakey. Ethernet uses a building block called a PUP, which stands for PARC Universal Packet, and which is nothing more than a type of datagram. Dave is a very strong supporter of the datagram approach (almost a missionary) and encouraged me to study his paper describing the PUP (see the April 1980 issue of IEEE Transactions on Communications). Well, it turns out that the INTERNET and PUP designs were one and the same several years ago, and the Xerox people had to split with the INTERNET community in order to tailor certain things for their own net and to get on with the job of implementing Ethernet in a reasonable timeframe.

The other person I talked to was Al Larson of SRI International, who has worked with INTERNET and has some idea of its usefulness and difficulty of implementation. I asked him about his reactions to using INTERNET as a standard for the amateur community and his response, in general, was very positive. We discussed several problems and limitations, and I will relate these later.

Well, let me get to the heart of the matter. I propose that AMNET and AMICON adopt the INTERNET standard intact, with a couple of minor extensions to solve some of our special problems.

First, this protocol is a standard, adopted by the DoD, ARPANET, and supported by many other major packet carriers. It represents the experience of ten or more years of computer networking and the contributions of hundreds of researchers and developers of packet technology. The specification is complete, a publicly available document (through NTIS), and can be used in a fairly simple way by our network. It provides us with the datagram building basis which I feel is important. It conforms to currently accepted practices of multi-layer network design, and could be used both on a national and international basis.

Second, it would make us compatible with DoD and some other networks to which we might eventually want to interface. Amateurs have had a long history of cooperation with the military (MARS, for example) and this would represent a continuation of that cooperation.

Third, it would save us an enormous amount of development time in bringing up our network. I'm really afraid that if we started with something much simpler, as some hams will encourage us to do, we would find in a year or two that features are lacking and extensions are necessary. Much discussion and haggling would produce a new and revised spec, and piece by piece we would eventually reinvent most of the features that are currently in the INTERNET document. I think it's much more reasonable to take this design and declare certain features as optional for our network.

Next, I have not seen any serious counter-proposals on how we should do networking, and I don't know who's going to find the time to write as comprehensive a document as this one.

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Finally, I really think that the protocol would work for us, and serve our needs in a reasonably economical manner. The INTERNET protocol permits us to adopt TCP or some other set of end-to-end protocols in the next higher layer of the network. It allows us to use HDLC as the link level and local area network mechanisms for delivering packets to the end-user stations. It's compatible with what we need for the satellite net. It has some really neat features, and I would like to see some comments on why we shouldn't use it.

In looking over this document the application of the standard is fairly straightforward except for one area, and that concerns addressing. A four byte source or destination address is specified, and that does not meet our needs. The first byte of this four byte field represents a network, and about 40 of the possible 256 combinations are already assigned. I attempted to contact the author of the document to see if a number could be assigned to an amateur radio experimental network, or to see if there already was a number for personal computing networks, but John Postel was out of town, and I didn't get an answer to my question. It seems clear that 256 networks is somewhat limiting, and that some future revision of the standard will have to expand this field. In the meantime, we should assume that this field is reserved and not to be used by us, and if we don't get our own network number, we can set the field to zero.

Well, that leaves three bytes or 24 bits of addressing, a selection of 16,777,216 integers which can be assigned to unique entities in our network. That number is large enough to assign each amateur on earth a unique code. Doing that, unfortunately, does not help the routing problem very much because one would need a callbook type of directory to translate these digits into people or places. It also does not take advantage of the uniqueness of callsigns and our familiarity with and use of calls. I propose to utilize the 24 bit address field in the following manner:

Addresses only have to be assigned to stations serving as network traffic processors, such as repeaters, gateways and mailboxes, and other individual stations do not have to have an address if they are accessible via a local net served by such a gateway or repeater.

The high order 16 bits (65,536 integers) can be assigned to stations based on their geographic location. It turns out that 360 degrees longitude multiplied by 180 degrees latitude provides for 64,800 locations, just under the 65,536 permitted. The remaining low order 8 bits can be sequentially assigned to stations within the same geographic area. If all 256 slots are filled, the nearest open slot can be assigned. Numbers above 64,800 are reserved for satellite stations and special cases. This method of address assignment is both rational and allows repeaters to implement message routing without any prior knowledge of the location of the recipient.

The callsigns of the sender and receiver will be located in the options field, using two of the unassigned control option numbers. Thus the packet header will consist of the standard 20 bytes plus 12 to 16 bytes of options containing the sending and receiving callsign. Explicit routing of messages is still permitted through use of the source routing option.

Some of the complexity of the INTERNET standard could be reduced by restricting use of the following features:

Fragmentation - Breaking up a packet is not necessary if the buffer allocation is large enough. The standard specifies a 576 byte maximum packet size.

Service Type - This is an option which can be ignored. Useful for interactive vs. batch traffic, or priority message handling.

Security Option - Not required in our network.

Stream Id - Not required

Timestamps - Optional

When we eliminate the requirement for the above items, we really have a basic set of features which are needed for an easy-to-use and versatile network service. Some of the features, such as error reporting, will be necessary to help people figure out what's going on. Other optional features will be useful in testing and measuring network performance.

So, there's a proposal on the table. Can we get some comments?

Best regards,

Hank Magnuski, KA6M

FILE QST.81.08.31.0.VE7APU

David Altekruise, W6RAW

Hi Dave,

In regards to your inquiry as to what we have been doing with S-100 8273 boards. Yes, we have made two S-100 wire-wrapped boards here. The first board was designed to operate on an Altair 8800 mainframe using the original Altair 8080 cpu card. This was built a couple of years ago and worked successfully. It used the Intel 8259A priority interrupt controller and the intel 8253 triple interrupt timer in order to provide for line timeouts, transmit-receive switching timeouts and a time-of-day clock. It had a single 8273 as well. The problem with this board was that it only had one channel and was only suited for use with an 8080.

More recently, we have built an S-100 card with many more features than the original card. Here is a list of some of the

main features:

1. Four 8273 chips for four channel operation.
2. Each channel can be set to it's own Baud rate.
3. Each channel supports a synchronous or asynchronous modem.
4. 2 - 8273s for six programmable timers.
5. Line timeouts by timer for each channel.
6. 2 - AMD9519A chips to provide 16 directly vectored priority interrupts supporting any type of microprocessor. 8080, Z-80, 8085, 8088, 8086, and just about any other type of microprocessor since this chip can be programmed for the interrupt type.
7. Jumper selectable for either two 2716 or two 2732 EPROMs on board with contiguous addressing.
8. Hardware timeout on request-to-send lines causes vectored interrupt to monitor for transmit lock on detection.
9. Software failure causes vectored interrupt to monitor.
10. Timers and HDLC channels operate with interrupts.

Well, these are the main features. The boards were designed to act in station nodes in our network. Bob Livingston, VE7CYB has expressed an interest in wire-wrapping an identical board for you so that our software for the station node program would run in your system directly. Or vice-versa, any programs that you write would run in our system as well. The board is very dense with the four channels and could not be made into a two-sided S-100 PC board. I hope that answers your questions. The only other person I know who is working on making a board of this type is Stu Beal in Hamilton but he is not finished the board yet which is also wire-wrapped and is somewhat similar to our earlier board.

If you are still interested, please write again. I may be able to supply you circuit diagrams for these boards.

73, Doug, VE7APU

FILE QST.81.09.02.0.KA6M

Date: 02-SEP-81 0915 PDT

From: H. S. Magnuski, KA6M

To: Packet radio enthusiasts

Subject: Summary of our September packet radio seminar

The third seminar in our series on packet radio was held last evening, and was attended by 25 people. The theme of the meeting was "Interfacing to the Network".

Announcements -

Howard Nurse, W6LLO, has his 20M packet station available for schedules. He would like to make some contacts to checkout the equipment, as no one else in this area is ready. The station will, in general, be connected to the mailbox system here, but it is currently not continuously on. Please call me or Howard, or send us a message.

Hank Magnuski distributed a 555 based watchdog timer circuit for transmit PTT protection.

Brian Yee volunteered to try mounting 3 MK4118N3 1kx8 RAMS on his VADCG board to implement a downline loaded version of the protocol.

The VADCG 1200 baud modem schematics, recently received, were inspected by the group.

Brian Yee and Dave Altekruze described their recent meeting with Larry Kayser, VE3QB. There were several questions concerning the satellite channel, and more information is needed on the details of the Vancouver-Ottawa link.

Speakers -

The main topic of the meeting was a description of how some of our network users have connected their personal computer systems to packet.

Bob Reiling, W6JHJ, who has an OSI 6502, described his station and gave us a peek at the FORTH programs he uses to control his packet board. Bob also mentioned his interest in installing a "Conference Tree" service on his system.

Warren Struven, W6CB, related some of his experiences in working with a FORTH interface for his H89.

Brian Yee, KD6LI, detailed some of the modifications he made to the MODEM7 program for his S-100/CPM system.

Finally, Ed Mersich, WA6RZW, outlined his conversion of an H8 to packet, and reviewed his plans to couple two H8 systems to packet and allow outside users to operate his system via the repeater. There was also some discussion on the merits of using a general purpose system for packet instead of a dedicated controller such as the VADCG TNC.

In summary, it seems as if most of our users are planning on coupling fairly large systems to the net, and there is high interest in resource sharing and services. The presentations also pointed out the tremendous diversity of systems in use, and yet there is little trouble in getting these systems to communicate with the current packet setup.

Network Usage Survey -

To wrap up the meeting and to get an answer to the question of "What are we going to use it for?" a matrix of interests vs. potential users was constructed by the group:

Topic

Votes

Experimentation/Design/Technical	9
Computer conferencing	7
Electronic Mail	6
Resource Sharing	3
Program sharing/User groups	2
Packet Video	2
Packet DX & QSO's	2
Traffic Handling	1
Packet Audio/Voice	0
Games	0

FILE QST.81.09.03.0.VE3QB

I asked Larry Kayser to give us a more complete description of the Ottawa- Vancouver satellite link, and here is his response:

TO: HM
 FROM: LSK
 SENT: 03 SEP 81 10:20:12
 READ: 04 SEP 81 08:19:16

KA6M, Hank

This is a description of the satellite system we are trying to make work to Vancouver from Ottawa. I have drawn it out and will word-describe it to you.

At the Ottawa end we have a 222.34 MHz digital radio terminal running on 9600 BPS connected to the Terminal port on a VADCG micro board. The EPROM software on the VADCG board has been modified to interface to our terminal node software in EPROM in place of the VADCG terminal terminal software. The balance of the software in the VADCG board is standard - at least as Vancouver sees standardization. The output of the VADCG board is connected to an old WECO 202D type modem which is in turn connected to the Satellite earth station audio equipment via a 4 wire connection. The satellite station runs via our domestic satellite ANIK in the 12/14 GHz band and is an FM sub carrier on a video channel. The video is two way and part of the Knowledge Network experimental program here in Canada. At the far end another 202D is connected to the satellite earth station and then a short cable at RS232 is connected to yet another 202D modem. This second modem is connected to a 146 MHz radio and uses one of the RS232 signal leads to key the radio on and off. The site is easily accessible in Vancouver however in Ottawa the site is not repeat not accessable without prior arrangements and then only in the daytime when we are all at work.

At this time we can get packets to them part to most of the time. They are not able to get packets to us at all. The problems probably stack up something like this:

1. The timing characteristics of the 202D units are not well understood from a system perspective and in fact the "back to back" units are a real mish mash and Vancouver is working to put

two VADCG boards "back to back" and try and cure the problem that way. This is fraught with a lot of problems and I am trying to put some other members of the brotherhood who are in the transmission business on it so we can measure it all and make it work because we understand it rather than our current method.

2. In addition we have no idea what the proper TLP's for the earth station connect points are as well we have no info on the specs for delay distortion and impulse performance. If the hunt and peck method doesn't work we will have to go back in and have a go at it.

Listening in to the system via the satellite down link is probably not possible as the foot print on the earth is much more controlled from the results we get on 4/6 GHz. I have easily looked at ANIK on 4/6 in South Carolina but I suspect that the 12/14 is much further down - like about 15 to 20 db or more. It is not likely that you would be successful in pulling such a thing off. I am also not aware of the band plan or the sub carrier plan for the system so it might be a bit much.

Our intent for this is to show that it can be done and desperately try to put some non amateurs on our Ottawa Computer Group Community Bulletin Board through to a similar type of person in Vancouver. This is what the ultimate aim is and we still have a chance to pull this one off. After that it would be interesting to see what we could do with it and how we could get people to use the thing. In the series sense it is a lot of stuff to get running all at once and frankly if we didn't have our message resource between us the progress would be frankly one tenth of speed.

So for now that's about it. I can answer any questions the group might have and try and be more specific on points if anyone is interested.

de Larry VE3QB

FILE QST.81.10.24.0.KA6M

Date: 24 OCT 1981 21:20 PDT

To: All packet radio stations

From: Hank Magnuski, KA6M

Subject: Notes on October 16th meeting at Gaithersburg

Here are some notes and impressions on the meeting I recently attended. A more complete report will be given at our next seminar.

1. The meeting was attended by 75-80 people. Quite a few in attendance were very well qualified and knew a lot about packet networking. I predict the meeting will have a wide ranging impact and be a big push for packet radio. The conference proceedings will be very widely distributed, I think.

2. A lot of the papers were future plans or proposals or theory. I believe the SF group is probably the largest user community in the world, by a margin of two or three to one.

3. Made new contacts of people in San Diego and Tuscon. Will help our western net grow.

4. Swedes are putting together a net at Linkoping Univ. They may be able to provide us with a high-speed modem design, as it is a current research project there.

5. Doug Lockhart was the only other person there promoting a network design. My proposal to use IP was warmly received by several parties. We have to find a tiny-TCP to complement it. The AMICON design may eventually dictate world standards, so it takes on additional significance. Doug and I disagree somewhat on the Datagram vs. Virtual Circuit approach to networking. Some agreement was reached, however, on terminology and partitioning of network functions.

6. Lots of FORTH enthusiasts. Some version of the network software will undoubtedly be written in that language.

7. An AMRAD-CAL will most likely be formed to promote packet net standards for the West Coast.

8. An outline of the East Coast backbone repeater links was put together. People and places were identified for a net starting in Toronto, going to Ottawa & Montreal, down through Albany to NY/NJ, side spur to Boston, down to DC then into Virginia.

9. Dave Borden, K8MMO, really liked the repeater hardware based on the STD card layout & bus. It may be that a Vancouver II design will turn out to be implemented in STD hardware, rather than as a single board micro. There is more flexibility with that approach, and a more compact physical layout.

10. There was a well researched presentation for 600 Hz. shift to be used for HF packet work.

11. Plans are being made for a packet session at Dayton, and a second annual networking conference.

12. I have a limited number of Vol I of the proceedings. A \$5 check payable to AMRAD will get you Vol I from me, and the second volume soon from AMRAD. Come by and see me, or send me a check and I will bring it to the next seminar.

FILE QST.81.12.06.0.KA6M

Date: 06 December 1981
To: All packet stations
From: Hank Magnuski, KA6M

Subject: Local Area Network Design Issues, 2nd Edition

The following is a random collection of requirements and design issues related to the construction of a local area network. Some of the ideas are very preliminary and some of the requirements may conflict with each other.

This is a set of notes and should not be taken as a well thought out discourse.

1. We must consider the situation where there are multiple repeaters on the same frequency with overlapping RF domains. Some stations may be able to access all, others just one. Duplex machines won't work (they can hear the users, but not each other due to mixup of in & outs). No interlinking on another band (such as 450) is assumed. The repeaters, links, and users are on the same channel. This is the worst case situation, but a realistic one.

2. No single Control Station should be "in charge" of the operation of the other repeaters. They all act as fairly independent entities.

3. Users stations ought to be able to move into an area and setup and start transmitting without any prearranged address assignment or placement on a polling list.

4. The long term solution will not depend on unique, permanent assignment of HDLC addresses to users. The callsign is the only item that is really important.

5. Users should have some control over which repeater they wish to access, and whether to use a repeater at all.

6. Direct connections between stations must be permitted.

7. Target stations (of a connect) should automatically adjust their output to return packets via the repeater/non-repeater path initiated by the connecting station.

8. If the connection is direct or through just one repeater, the protocol could be simplified and overhead bytes could be eliminated. The Internet Protocol (IP) header would not be needed.

9. If two or more repeaters are in the chain, IP headers will most likely be necessary, but possibly one could arrange a connection through a limited or well defined path without use of the IP header.

10. Repeaters should be available for status checks, loopback testing and diagnostics. Thus there will be packets or commands directed to the repeater which are intended for processing by the repeater.

11. Maybe a repeater should implement "please-repeat-me/don't-repeat-me" status bits for each user address available. Users should be able to selectively address or access each machine or network server. A "please-repeat-me" directed to one machine should be interpreted as "don't repeat-me" by other machines. For broadcast protocol purposes (round-tables, nets, etc.) one may wish to say "Will-everybody-please-repeat-me".

12. Repeaters will send "Repeater-ON" status message and current routing information to other repeaters in the network. Repeater beacon messages inform users what machines are operational and their addresses.

13. Hop-by-hop error checking would provide satisfactory reliability for the proposed datagram implementation.

14. Static assignment of HDLC addresses would be ok for permanent stations like repeaters or other network servers.

15. No static assignment of addresses implies:

- a.) Dynamic assignment is required -or-
- b.) Use of IP headers is required everywhere

16. Dynamic assignment of addresses implies:

- a.) All servers covering one area are coordinated and don't assign the same address to different users.
- b.) Deassignment of addresses must be foolproof and implemented through user-initiated commands or through timeouts. No conditions should permit an address to "lock-up" to a non-existent or inactive station.
- c.) An Address needs to be defined for users who don't have an address to ask for an address. Probably 00 or FF, with FF most likely.

17. Use of IP headers implies:

- a.) More overhead per packet, approx. 30-40 bytes.
- b.) Only one HDLC address code is required for all users.
- c.) From and To callsigns will be in each packet.
- d.) From and To network node address will be in each packet.
- e.) Other useful info in header, such as protocol type field.
- f.) More overhead on the software, which will be receiving, storing, and checking packets not destined for its station.

18. Some block of HDLC addresses should be reserved for network usage and servers. Here is one proposal for assignments:

00	Maintenance or NOP address
01-7F	Direct connect for stations not using IP protocol headers

80	Reserved
80-EF	Repeater connection for stations not using IP protocol headers
F0-FD	Network repeaters, servers and gateways using IP headers
FE	User station common calling address, IP headers in use
FF	Broadcast, all-parties-addressed, no IP headers

Perhaps a block of addresses should be reserved for future use by another protocol, or for special cases, or for other currently unforeseen emergencies.

19. If repeater with address F9 receives a packet from machine F1, it would look into its routing tables and find the next repeater which should receive the packet, say FC. It would put FC into the outgoing address, and retransmit the packet. Thus we utilize selective addressing and can aim the packet in the direction we want, based on our routing decision.

Selective addressing could also be implemented by using the "source route" option in the Internet Protocol. The repeater which is the initial link in the chain is listed as the first destination in the destination address field. The address(es) in the source route option will then replace the initial repeater's address and speed the packet on its way.

20. In addition to the address ranges, we have control over the type of packet sent as defined in the HDLC control field. What use should be made of Non-Sequenced-Information (NSI) field packets (and other types)?

21. Protocol should allow host machines to simultaneously handle multiple connections with different users. Also, multiple independent streams, e.g., console I/O and printer I/O simultaneously, should be easily implemented.

22. What requirements do real-time broadcast protocols impose on the design?

23. Summary of various cases:

I. Direct	A - B
II. Single Repeat	A - R1 - B or A - Rn - B
III. Double Repeat	A - R1 - R2 - B
IV. Linking	A - R1 - R2 - ... Rn ... - B
V. Repeater Command	A - R1 - A
VI. Broadcast	A - Rn - B, C, D, E, ...

24. A repeater can be addressed in several different ways:

- Use of its own callsign in an IP header
- Use of its network node address in the IP header
- Use of its own special F0-FD address.

25. Various classes of packets which a repeater will have to

handle:

- a.) IP packet with F0-FD address, "To" Node is repeater's.
- b.) IP packet with F0-FD address, "To" Node is not repeater's.
- c.) IP packet with F0-FD address, "To" Node & Call is repeater's.
- d.) IP packet with FE address, "To" Node is not repeater's.
- e.) IP packet with FE address, "To" Node is repeater's.
- f.) IP packet with FE address, "To" Node & Call is repeater's.
- g.) IP packet with FE address, "From" Node is repeater's.
- h.) NSI packet, an F0-FD address, with command or control text.

The corresponding situations are these:

- a.) Repeater is last or only link in a linked chain
- b.) Repeater is a middle link in a linked chain
- c.) Repeater itself is the final target of the packet
- d.) Packet is for another server, unless case g below.
- e.) Repeater is last or only link in a linked chain
- f.) Repeater itself is the final target of the packet
- g.) Repeater is a beginning link in a linked chain
- h.) Repeater itself is the final target of the packet

The above list does not cover the non-IP header packets which might be in use by a local area net. It also assumes the "source route" option, mentioned in (19) above, is not in use.

26. For a station to automatically return a packet over the path on which it came, the following steps are necessary (IP protocol is assumed):

- a.) Exchange source & destination node numbers
- b.) Receive and transmit using standard FE calling address.

The repeater (or non-repeater) which delivered the packet will automatically pick it up and retrace the path.

The Internet Protocol also provides for a "return route" option in the header. It could be used on a connect packet to indicate the path to be used in responding.

27. Direct connect stations using IP protocol can use "NET 00 00 00" as the network node address. NET is decimal 44.

FILE QST.81.12.15.0.N6FTZ

DATE: 15 DEC 81
TO: ALL WHO HAVE VADIC 202 MODEMS
FROM: DAVE ENGLE

HERE IS THE INFORMATION THAT IS NEEDED TO CHANGE THE VADIC 1230D MODEM BOARD TO OPERATE IN A MANNER ACCEPTABLE TO PACKET RADIO.

THERE ARE THREE CHANGES PRESENTED IN THIS NOTE, THEY ARE:

1. A CHANGE TO ALLOW THE DATA SET READY (MODEM) TO GO ACTIVE WITHOUT HAVING TO ANSWER A PHONE CALL.
2. A CHANGE TO SEPARATE OF THE TRANSMITTER AND RECEIVER LEADS.
3. A WAY TO ALTER THE TIME DELAY BETWEEN REQUEST TO SEND (RTS) INITIATION AND RECEIPT OF THE CLEAR TO SEND (CTS) SIGNALS.

1. ENABLE COUPLER CUT THROUGH -- MAKE DATA SET READY:

- A. VIEWING BOARD WITH PC CHASSIS CONNECTOR TO LEFT (WHITE BOXES TO LEFT ALSO).
- B. LOCATE M16 ETCHED ON BOARD (MIDDLE, BOTTOM).
- C. FIND 62K RESISTOR TO LEFT OF M16 ETCH.
- D. UNSOLDER LOWER END OF 62K RESISTOR FROM BOARD.
- E. LAY LOWER END OF RESISTOR ON FAT TRACE THAT WENT UNDER THE RESISTOR IN IT'S ORIGINAL LOCATION.
- F. SOLDER THE LOWER END OF THE 62K RESISTOR TO THE FAT TRACE.

THIS WILL SUPPLY A NEGATIVE (TRUE) SIGNAL TO THE CCT ENABLING THE MODEM'S DATA SET READY (DSR) SIGNAL.

2. SEPARATION OF THE TRANSMIT AND RECEIVE DATA LINES:

- A. REMOVE STRAP "A", IT LOCATED AT THE TOP LEFT END OF THE SMALL WHITE BOX. THIS WILL SEPARATE THE TRANSMITTER AND THE RECEIVER.
- B. REMOVE STRAP "T", IT IS LOCATED NEAR J2 (THE 9 PIN CONNECTOR). THIS UNGROUNDS THE DATA TIP J2 PIN 8,
- C. UNSOLDER THE WIRE FROM J2 PIN 6 AT THE PC CARD END. THIS REMOVES -12 VOLTS FROM PIN 6.
- D. SOLDER THE LOOSE END OF THE PIN 6 WIRE TO THE TOP HOLE OF STRAP "T". THIS PROVIDES A SIGNAL COMMON FOR THE TRANSMIT AND RECEIVE LINES.
- E. UNSOLDER OR CUT THE WIRE FROM J2 PIN 9 AT THE 1K RESISTOR. TAPE OFF THE END OF THIS WIRE AS IT WON'T BE USED. THIS IS A SAFETY MEASURE TO REMOVE +12 VOLTS FROM THE COMMUNICATION LINE CONNECTOR.
- F. RUN A WIRE FROM STRAP "A" RIGHT HOLE (TRANSMITTER OUT) TO THE BOTTOM HOLE OF STRAP "T" (DATA TIP). THIS CONNECTS THE TRANSMITTER TO THE COMM CONNECTOR (J2).

THE COMMUNICATION LINE CONNECTOR J2 IS NOW CONFIGURED WITH:

J2 PIN 6 AS SIGNAL COMMON,
J2 PIN 7 AS RECEIVE DATA (DATA RING),
J2 PIN 8 AS TRANSMIT DATA (DATA TIP),
J2 PIN 9 IS UNCONNECTED.

3. ALTERATION OF THE TIME DELAY BETWEEN REQUEST TO SEND (RTS) AND CLEAR TO SEND (CTS):
 - A. THE PRESENT TIME IS SET BY A RESISTOR (57.6K) AND CAPACITOR (3.3 MICROFARADS) AT APPROXIMATELY 200 MILLISECONDS.
 - B. THE NEED TO ALTER THIS WILL BE DETERMINED BY THE SPEED AT WHICH YOUR TRANSCEIVER CAN SWITCH FROM RECEIVE TO TRANSMIT (AND COME UP TO FULL POWER). THE VANCOUVER BOARD WILL RAISE RTS AND THEN SEND DATA AS SOON AS IT GETS CTS IN RETURN, SO THE TRANSMITTER RF UNIT HAS TO BE READY TO GO AT CTS. SYNTHESIZED RIGS AND RIGS WITH RELAYS IN THEM (RATHER THAN SOLID STATE SWITCHING) WILL PROBABLY NEED A LONGER TIME DELAY.
 - C. THE TIME VALUE IS EQUAL TO THE RESISTOR VALUE (IN OHMS) TIMES THE CAPACITOR VALUE (IN FARADS), DOUBLING THE CAPACITOR VALUE WILL DOUBLE THE TIME VALUE ETC.
 - D. THE RESISTOR AND CAPACITOR ARE LOCATED JUST TO THE RIGHT OF THE M20 LABEL ETCHED ON THE PC BOARD (BOTTOM), THE RESISTOR IS JUST ABOVE M20 LABEL, THE CAPACITOR IS BELOW THE M20 LABEL (WATCH OUT THE RESISTOR IS CODED WITH A FOUR BAND COLOR CODE).

HAVE FUN, IF YOU HAVE ANY PROBLEMS GIVE ME A CALL AT HOME
408/251-2910 IN THE EVENING.

73
DAVE ENGLE

FILE QST.82.01.09.0.KA6ETJ

To: Hank KA6M

From: Jim KA6ETJ

Subject: Apples on Packet

I was able to get my Apple and Vancouver board up and running on 2-JAN-82. It was really an exciting experience and the perfect marriage of computers and HAM radio.

I experienced no difficulty with the hardware. I had pretested the VADCG board on W6JHJ's system so I had confidence in that portion of the system.

All of the problems that I had centered around the Apple and the serial interface. I am using the Mountain Computer CPS

Multifunction card. Since the current version of TIP does handshaking I decided to run at 9600 baud. What this entails is generating a machine language driver that bypasses the CPS firmware and communicates directly with the 2651 PCI. The program was not all that hard but there were three things that tripped me up. I will transmit the source code separately.

1. The reset message in the TIP-M03 does not do any handshaking. This caused me problems because I was initially bringing in characters one at a time. This is fine until you reach the bottom of the screen and start to scroll. I lost most of the message when I reached the bottom. The solution is to use a buffer and when there is a break output to the screen.
2. As you are probably aware of the Apple does not normally display lowercase characters. For some reason I completely forgot about the possibility of having to input lowercase characters. I was able to input and display the reset message but the handshaking didn't seem to work. At the same time I was receiving the Beacon consistently but the message was garbled or at least part was and part was fine. The solution was to test for lower case and then convert to uppercase.
3. Lastly the way to input the special character 1E hex from the apple keyboard is with a CTRL-SHIFT-N. I was making the mistake of thinking that it was just a CTRL-N.

I am continuing to work on the terminal program. I will transmit to you in a seprate file the current version. It does the terminal interface that is transmitting of characters from the keyboard and the receiving and displaying of characters to the screen. I am setting it up so that the terminal program will be in memory along with a screen editor (Apple Pie). The Editor already takes care of handling binary and textfiles so I will load a file into the edit buffer using Apple Pie then jump to the terminal program and transmit the contents of the buffer. At present I have the above implemented. The next items to be added are the ability to recieve directly into the edit buffer for saving to disk or printing. Also I have added a macro I can use to log on to ka6m** with two key strokes. As I use the system more I am sure there will be more embelishments.

I have sure gotten a lot of enjoyment out of getting onto Packet radio and I am willing to help others discover the fun of Packet. My XYL probably like most cannot understand how anything to do with radio or computers can be fun but at least it keeps me home.

Happy Packets! Jim, KA6ETJ

MINUTES OF PACKET STEERING COMMITTEE MEETING 12 JAN 1982

The first meeting of the Packet Steering Committee was held at 311 Stanford Ave., Menlo Park, Ca., at 8:00 pm 12 Jan 82. Initially members were asked to comment on their interests and to state specific questions related to packet radio development in the Bay Area. These concerns were noted:

1. A packet radio link be established to link the Bay Area to other areas in California, particularly Southern California.
2. We, as a group, should encourage greater participation in packet radio.
3. Our group should have low membership dues, and no initiation fees. However we must have enough capital to fund our projects.
4. We should consider merging our group with the national AMRAD group.
5. We organize to form a local group with specific objectives. This group should have a non-profit status and be incorporated.
6. A better mailbox system be established for packet.

Next on the agenda was the question of what specific goals we have for the remainder of the meeting. Topics included, what kind of group to establish, what the name of the group shall be, objectives of the group, geographic scope of activity, affiliation with other organizations in other areas, and short range goals. The following items were agreed to:

1. We shall form an association of individuals with the intention of incorporating into a non-profit organization at a later date.
2. The name of this group shall be, "The Pacific Packet Radio Society".
3. The primary interest of PPRS shall be the advancement of amateur packet radio. PPRS shall not be limited to packet radio exclusively.
4. Dave Engle (N6FTZ) volunteered to be by-laws chairman. Dave will present a draft of the by-laws to the steering committee at the next steering committee meeting. The by-laws shall be approved by the steering committee before presenting them to the potential membership. Ed Mersich (WA6RZW) will assist Dave with the by-laws.

5. Brian Yee (KD6LI) is the seed member of the hardware committee. Brian will do preliminary research on site, and frequency possibilities. He will also research possible sources of equipment. Brian will present his findings to the steering committee.
6. Curtis Spangler (N6ECT) has agreed to chair the public relations committee.
7. Bob Reiling (W6JHJ) has been appointed to chair the external affairs committee.
8. Hank Magnuski (KA6M) and John Gilmore are seed members of the software development committee.
9. Jeff Sue (WA6SLF) has agreed to research a new mailbox for packet radio.
10. The next steering committee meeting will be held on 8 February 1982, at 8:00 PM at 644 Ashbury St., San Francisco. Contact Curtis 552-3430 for directions.
11. The first PPRS membership drive and meeting will be held on 23 Feb 82 at a location to be announced at a later date.

The Pacific Packet Radio Society Steering Committee members are:

Dave Engle	N6FTZ
John Gilmore	GNU
Hank Magnuski	KA6M
Ed Mersich	WA6RZW
Bob Reiling	W6JHJ
Curtis Spangler	N6ECT
Jeff Sue	WA6SLF
Brian Yee	KD6LI

FILE QST.82.01.23.0.GNU

Gnu here.....this is the promised TNC wishlist.

John Gilmore, 401-1/2 Clayton St, SF, CA 94117 415-864-2891
"GNU"

Wish List for a new Terminal Node Controller board

(1) 8 byte-wide memory sockets (28-pin) with addressing jumpers or prom flexible enough for 16K, 32K, or 64Kbit chip use. It should be possible to mix sizes as long as you don't mind holes in your address space; better would be random mix without holes. Please, Please, get rid of the 2708's and go with 5 volt only chips.

(2) One or two LED numerals, or a set of LED lights, on the board. For displaying the status of the software/hardware.

(3) A socket for burning EPROMs (with separate 25 volt power supply (3 9volt batteries and regulator)), or EEPROMS as the price drops. This would allow downloading new versions into EPROM over the net.

(4) Option for battery backup RAM. This would allow downloading the controller software into RAM and having it keep.

(5) Options for multiple terminal devices attached to the board..eg

- 1 serial port, 1 parallel port (AT THE SAME TIME!!!)
- 2 serial ports

This is pretty easy to support in software (as two HDLC addresses, for example) but can't be done with the current board. I want to connect my Apple as a host and my terminal as a terminal, to the same board. It'd also be possible to run a printer off one and a terminal off the other -- getting listings in the "spare" time when the terminal wasn't generating packets.

(6) Bring all the CPU pins out to an edge connector, so we don't have to resort to awful kludges to extend the board when we want to do further experimenting or production use. Like, ever try adding memory or I/O to a VADCG TNC? Best idea I've come up with is piggybacking into the CPU socket...eech.

(7) A set of switches (DIP) or a hex input dial which is readable by the software. (The DIP switch on the VADCG TNC is nice, but unfortunately useless -- a jumper would've been better -- how often do you change your modem baud rate???)

(8) Possibly use a more popular processor. Z80's are easy to find; 8085's are hard to find (even in Silicon Valley, they don't carry them at Radio Stack). Even better would be a newer generation processor like the 6809, which would also be compatible with the Swedish FORTH efforts.

(9) Full kit (w/parts) and/or A&T and/or A&T & packaged with modem and radio would be nice. I'm at the moment stuck off the air because I can't debug my board because finding loaner scopes is not easy, and I'm not a hardware hacker.

(10) A real timer chip should be included, or at least a socket for one. We'll need it for accurate timekeeping for time-division muxing schemes, which will soon be required with multi repeaters on one frequency at 1200 baud. Else congestion from hidden terminals (which rptr can hear but you can't, thus you transmit and collide) becomes a real mess.

(11) Parallel ports should be connected to a DIP header, rather than to a DB25. You can connect a DIP header to anything pretty easily, while DB25's are expensive and painful to use when there's no obvious reason to do so (like, when you're connecting to an async serial device).

Please consider all of these and winnow out those you can't implement -- but I guarantee I can find a software use for everything here, if you'll provide it.

Thanks for listening. -- John (GNU)

FILE QST.82.01.23.0.WB2CAM

The Proceedings of the East Coast Packet Radio Standards Meeting

Flemington, N.J. 23 January 1982

The meeting commenced at about 10:30 with some opening comments by Paul Rinaldo, W4RI. At this time, an agenda which he had prepared, was distributed.

Dave Borden, K8MMO gave a presentation on the fundamentals of packet radio. His talk cleared up some of the mystique surrounding bit-synchronous protocols and the devices designed to implement them. It was noted that the Intel 8273 and the Western Digital 1933 were the only two devices which allowed for the derivation of the clock from the NRZI-encoded data. Dave also brought up the legality of bit-stuffing and the reaction of certain FCC personnel to some of the grey areas into which we are headed. The conclusion was that the FCC is open to petitions regarding cw identification, and to requests for authorization to use modulation techniques varying from the present bit=baud regulations.

The FCC also feels that a single frequency digipeater is in fact a repeater of the time-diversity flavor. Therefore, it is important to remember that these machines must be placed in the repeater sub-bands. This brings up a question as to whether a mailbox station on the lowbands is a repeater. It should be noted that the difference between a mailbox and a repeater is that the relay delay time for the mailbox is longer. Some thoughts on this point would be appreciated by this writer.

The next presentation, was made by Terry Fox, WB4JFI. Terry's comments were on the hardware and software limitations of the Vancouver boards and of the S-100 interface he has designed. It was determined that the Vancouver boards have a maximum link capacity of about 19.2 kilobits. It was made quite clear that for switching nodes, a new hardware design with more "horsepower" would be in order.

Several presentations followed in fairly rapid succession. These were made by representatives of the other groups.

Gwyn Reedy, W1BEL of the south Jersey group reported that several Vancouver boards had been completed and were in the testing phase.

Paul Newland, AD7I of the Holmdel group mentioned that he had 202 compatible modem and TNC designs which were in the process of release. He noted that the TNC was Z-80 based and used the Zilog SIO. This afforded the user two flexible serial interfaces in one package. Some software has been written and the boards do talk. Paul pointed out that the Zilog SIO does not

have a clock recovery circuit and therefore requires external circuitry to perform the NRZI-encoding. (author's note: buy a flip-flop...problem solved...).

Steve Robinson, W2FPY of the Ramapo Mountain Amateur Radio Club in Oakland, N.J., described the local progress to date. This included a few completed Vancouver boards, a 220 Mhz repeater for voice and data, plans for a digi-peater and local interest on the verge of explosion.

Bill Ashby, K2TKN of the Cherryville, N.J. Repeater Association has ordered twenty-five sets of TNC parts for his group to use. He described the extensive repeater configuration established by his group and the Raritan Valley Radio Club. Facilities include a plethora of sites at which the packet network could be located. These are some of the best sites in the state of New Jersey. Bill has also offered some support in the establishment of point-to-point links between systems in the area.

Gordon Beattie, WB2CAM of the Radio Amateur Telecommunications Society outlined his group's efforts. A network of dial-up, password-protected, bulletin boards was described. It is in the first stage of implementation. The next step is the establishment of the on-the-air interfaces. This should be up within the month. This will yield valuable data on the loading of a CSMA-type network. It will ultimately be a network resource for all on the air to use. Plans for a unified regional network approach are under development and will require much coordination of the groups in the New York-Philadelphia corridor. RATS hopes to contribute to this effort.

A nice (and most welcome !!) lunch was served by our hosts, the Cherryville Repeater Association. Many thanks to Charlie Kosman, WB2NQV for his silent and generous contribution. During the lunch break, a number of small discussions were conducted. These alone were worth the trip !

After lunch Howard Lester, W2ODC who wears the hat of upstate New York coordinator, described the frequency scheme for the inter-city links to be used by the various groups in the state. He also commented on the development of the group as sparked by Den Connors, KD2S who is on a leave from R.P.I. and living for a few years in Tuscon, Arizona.

W4RI made a presentation on the three elements of "AMNET". They are HF, Satellite, and VHF point-to-point networks. Each will require some variations in protocol in order that the frequencies and modes be used most efficiently.

At this point the K8MMO commenced the "paydirt" portion of the meeting. The Internet Standard suggested was a variation of the ARPANET and NBS Internet Standards. It was mostly a learning and exploratory exercise and further discussions will be required. Dave suggested that the packet frame should contain the amateur call encoded as ASCII. An interesting point is that Dave suggests the addition of an extra character to discriminate between different stations or processes. For example, K8MMO, K8MMO*, K8MMOR. There was some question as to whether the call should be in the HDLC address field or in the information field. This will require further study.

W2FPY made a suggestion of a National Network with table

driven software. This was met with all kinds of comments, pro and con, but what Steve had to say made a lot of sense if a sufficient hierarchy is implemented in the network.

AD7I presented an addressing scheme that utilized the address-detection feature of the protocol chips by using a self-assigned "magic" number which would cause the generation of an interrupt, setting into motion the full id-checking algorithm. This number could be sent to the local station node at network logon time. Most of the chips also allow for an "all call" address, and control of the selective receive function. From this it is plausible to work up something for at least the station nodes. Something such as this, is especially useful for busy multipoint switching nodes and other stations handling multiple virtual connections.

Conversation went back to the Internet Standard for a while and then the discussion turned to our next meeting. At the time of this writing, no date has been set, but a general agreement was made to meet at the ARRL in Newington, Ct. on one of the last Saturdays in March and again at the Dayton Hamvention during the last weekend of April. It should be noted that Paul Rinaldo, W4RI will be making a presentation at the Hamvention on packet radio. I am sure Paul is looking forward to a good

Prepared by,
J. Gordon Beattie Jr.
WB2CAM R.A.T.S.

FILE QST.82.01.30.0.W2FPY

Summary of Local Packet Radio Meeting

Location: Wayne, NJ

Date: January 30, 1982

Attendees:

Carver Washburn, W2TFM (Host for this meeting)
Gordon Beattie, WB2CAM
Raymond Heisler, WA2PJV
Stephen Robinson, W2FPY

Protocols for networking were discussed in terms of black-box structures. This was done so that we could see how our local "wish-list" for network features, and our proposed local network topology would affect the local network and internetwork procedures.

The local "wish-list":

1. Group call-up: In amateur radio activities, it is desirable to send messages selectively to members of a group. If immediate response is unnecessary, this can be accomplished by store-and-forward techniques, with a copy forwarded to each terminal on the list. If immediate response is needed, as might occur in emergency/disaster coordination, or club voting, a "connectionless" form of

service should be used - ie: one in which packets may be sent and received without being enclosed by the connect/disconnect procedure.

2. Amateur callsign addressing: As per the suggestion of the AMRAD group (as of meeting 1/23/82), we agree that the only unique station "addresses" are the individual amateur callsigns. We further agreed that these addresses should be seven octets in length, thereby accounting for a full callsign plus a seventh character used to indicate the particular controller, repeater, or device of that individual. In all cases, the seventh octet will be the "unit-select"; calls shorter than six octets will be left justified and padded with trailing blanks up to the "unit-select" character.

3. Interruptable service: In times of extreme emergency, it is desirable to interrupt the normal flow of traffic for a QRR destined for all logged on terminals. It was decided that breaking a connection without following protocol might leave terminals in anomolous states. Connection may be interrupted at the level of the local packet repeater by the repeater originating the disconnect signals to all terminals prior to sending "connectionless" traffic. Connectionless traffic must be acknowledged by all terminals when it is necessary that all terminals are required to receive an error-free message. Another method for interruptable service, and one worthy of some research, is to provide for, using the seventh address octet, an emergency channel name. For example, the TNC might respond to the name "QRR" as well as its native callsign. This method implies that the TNC can maintain (by TDM) two or more channels of communication. The previous connection, if any, remains unbroken while the emergency traffic is received and acknowledged. Separate buffers and control blocks will be required in the TNC for implementing this protocol. The connectionless service implies that a permanent virtual channel exists to the TNC with the address "QRR" (or any other emergency name). An extension of this procedure would also allow the group call-ups mentioned earlier; that is, a permanent virtual channel is assigned for each group or service subscribed to. The virtual channels can be established at the first logon with the local node (repeater). This implies that a logon procedure is needed on a first-time basis, before there can be transactions. The logon establishes the terminal as a member of the local network. The implications as to the mpu and memory requirements need further study. It appears that this (latter) method may be the most reliable of the possibilities discussed.

4. Directories and traffic routing: The local node will keep a table of all station callsigns that have, at one time, "logged-on net". This table will serve the following uses:

- a) Identification of local subscribers for traffic entering the local net.
- b) Call-forwarding - an entry for the address of a remote repeater node is available for re-routing traffic. The update of this is the responsibility of the end-user, not the repeater management.
- c) Group channels - one or more group channels (which are permanent in nature) can be assigned to the terminal at logon (or update) time. This cannot be done without limit with present (amateur) hardware!

The group agreed on some general principles which may make the local network and external network "balanced".

1. HDLC framing will be used.
2. The HDLC address field will NOT be used as a unique source address. The unique HDLC source address will be deferred to the I-field. Rather, an address of FF might be used for a "QST", and 00 for all sessions. This usage is still undetermined.
3. The HDLC control field will be used as-is. We hope that the overall network will support the principle of POINT-TO-POINT ACKNOWLEDGEMENT. It is felt that to do otherwise would be wasteful of network resources. For instance, it would be undesirable for acknowledgement and message numbering to be postponed for the end user-terminals in a coast-to-coast multi-hop channel. Each repeater must number packets with INDIVIDUAL NUMBERING for each connection. The implications of this is that the local and internode repeaters must maintain separate control blocks for each session in progress; the control blocks must reflect the number of packets sent and the number received. Since two terminals communicating through a repeater must establish a channel with the repeater, each session via repeater must have two control blocks. The number sent and received can be different from the standpoint of the repeater and the terminal nodes.
4. The HDLC information field will contain a header for both local and non-local service. The first two octets are reserved for supervisory information. This is to be followed by up to four addresses of 7 octets each. The first two addresses are mandatory; these are the source and destination addresses (terminal node addresses). Repeater source and repeater destination addresses may follow this (optionally) for non-local service. The first address, which is the terminal node source address, will serve as the HDLC source address in local transactions. Note that this still allows for group addressing.
5. The packet length used in local networking should not be fixed at, say, 128 bytes. Rather we should allow variable length packets, up to a maximum of about 512 or 1024 bytes. This will maintain high efficiency locally. The maximum number of bytes per packet may be revised upward if a local high baud-rate repeater can be realized.

The packet length of the internode repeaters should be examined closely.

6. Routing was discussed in principle. We are considering table driven routing for local transactions. This type of service is very desirable for the internodal exchanges. The tentative rules are:

a) The local node (repeater) maintains the directory of all station in the local area. This can be done on a one-time-only basis by a logon procedure. It is the responsibility of the terminal user to establish his entry in the local directory.

b) The internode (internet?) repeaters maintain directories of ALL internet repeaters in the overall network. This table will identify the existence of that node, and identify the nearest neighboring repeater(s) to which this traffic can be handed off to. This directory is the responsibility of the repeater management. Although dynamic updating of repeaters may be feasible in the future, it can be handled by voice or written request for now.

c) As in ARPANET, the terminal user can address his traffic to another user as follows: If local (the default), only the destination callsign need be typed out in the request-to-connect. For example: "REQUEST TO CONNECT: WB2CAM". When the station addressed is non-local, the at-sign "@" will be used as a connective to indicate the destination node. For example, to call W4RI from a North-Jersey repeater, type "REQUEST TO CONNECT: W4RI@K8MMO".

d) Call-forwarding. The terminal node user, when travelling out of the local area, can logon at ANY node in the network, and instruct that node to send a message to the users "home-node" to forward all call requests to the current one. Note that this table driven scheme has implicit routing!

We concluded that it would be helpful to obtain a networking specialist to discuss our wishlist with. This would allow swifter implimentation of service for the local area, and simultaneously help us establish internodal exchange.

This summary was prepared by Steve Robinson, W2FPY, on January 31, 1982, for approval or amendment by the above listed attendees.

FILE QST.82.02.07.0.KA6M

Date: 07 February 1982
From: Hank Magnuski, KA6M
To: All Packet Stations

Today at 14:10 PST Howard Nurse, W6LLO, and K1RT successfully

exchanged HDLC packets on 14.075 MHz. The QSO was short and experimental, but packets were successfully exchanged in both directions.

As far as I know, this is the first HF contact on the West coast, and maybe the first HF contact on HDLC packet.

I would be interested in learning of any prior HF contacts to this one. Our thanks to Howard for getting it all together, and opening up a new pathway.

73, Hank

FILE QST.82.02.11.0.VE7ADE

TO: HM
FROM: DML
SENT: 10 FEB 82 23:19:44
READ: 11 FEB 82 09:05:31

Doug,

There have been several requests for information on repeaters. If I understand correctly, the program we had in the beacon ROM #5 was adequate for a start. The people at Camosun College are hot to trot and a repeater in Victoria that will guarantee access to Vancouver is one of the things they would like to get started on. They are first on the list for our kit and are anxious to get it as the course they are going to build it on is already going.

John Hopkins at BCIT is also interested in getting a couple of the boards as well and for the same purpose; to familiarize the students with the latest communications protocols.

Could you send us a repeater PROM suitable for use by the various groups looking for it. We need to publish it in the newsletter and make it available in PROM format. If the present program isn't acceptable (with the beacon part disabled or removed) can you tell me what it might take to get one going?

What is the Digipeater that the San Fran group have going?

Can you find out if Larry got the stuff I sent him on Bob's HF proposed experiment. Could you get his new unlisted number for us. Bob is anxious to get comments from him about it as he has just about finished the wire-wrap and will be ready to start on the air experiments, which Larry offered to help out with by setting up a second board at his end. I will put a copy of the note in the envelope with the rest of the PRNET proceedings.

GN, John

FILE QST.82.02.14.0.KA6M

Date: 14 February 1982
From: Hank, KA6M
To: All Packet Stations

I recently talked to Gordon Beattie from New Jersey about their progress. They still don't have their VADCG's running (to my surprise) and are less far along than I thought. Gordon invited me to log into his BBS, 201-785-3565, which I did, and I picked up two very interesting documents reporting on some recent meetings. Also picked up all current entries in their conference system concerning packet. These files are named NJ1.DOC, NJ2.DOC, and NJ3.DOC, and you are all encouraged to look at them. They will be on the system for about a month and then deleted.

Regards (and happy Valentine's Day too!),

Hank

FILE QST.82.02.23.0.VE7APU

PACKET RADIO NEWS FROM SWEDEN

I wrote a letter to SM5HEV, Jens Zander and arranged for a 'sked' on the HF bands. Last Sunday I got through on 15 and 10 meters and talked with Jens for about an hour. Signals were very good both ways. Here are some of the things he discussed:

Jens is working on his PhD at the University of Linkoping. He and Paul Forsheimer and a group of undergraduates are working on development of a packet radio system. They are developing both the software and the hardware. They have received permission from the Swedish Dept of Communications to test the system on 434MHz. and expect to make the test sometime this summer. I am especially interested in the packet radio they are constructing because they expect it to go at a speed of 100kBaud. From what I have been told the radio is designed very much along the lines that I proposed but developed totally independently. So far I do not have any details of the circuits, board layouts, etc. but Jens may be sending some detailed information to me in a few weeks. Jens specializes in the software and Paul specializes in the hardware for the project and I guess that the undergraduates do all the mundane work.

Jens also says that Karl Meinzer, DJ4ZC, at the University of Marburg who is a member of AMSAT-DL has told him that they are working on an Amateur Digital satellite which would work at 100kBaud. I understand that it is being developed with the help of an Amsat group in Hungary. I do not know any details at the present time so you can treat it as a rumour until it can be confirmed.

For those interested, I have another 'sked' with Jens this coming Sunday at 1515GMT on 21.220 MHz. My call is VE7APU/3 and

his call will be SK5EU. He is using the club station at the University of Linkoping. If we don't get through on 15M we will try on 28.470MHz. at 1530 GMT. I expect Paul to be around for the sked too. The times are probably a little early for you guys on the West coast.

73, Doug, VE7APU

FILE QST.82.02.24.0.KA6M

To: All packet stations
From: Hank
Date: 24 February 1982

Dave Borden has sent us a one prom packet repeater program for the VADCG board. The program is to be found in AMRPT.ASM, and the assembled version is AMRPT.PRN.

FILE QST.82.02.26.0.WB2CAM

Welcome to R.A.T.S. N.E.S.T. System 2
Located in Little Falls, N.J.
Operated by Gordon WB2CAM

This system is dedicated to the dissemination of information pertaining to Amateur Packet Radio.

Other topics such as computers, telephone systems, and related subjects are also welcome.

PACKET RADIO IS A REALITY !!!

ON 15 FEBRUARY 1982, A WORKING SET OF VANCOUVER TNC BOARDS WERE FIRST TESTED AND FOUND TO BE WORKING. ON THE 17TH, A SUCCESSFUL TWO-WAY CONTACT WAS MADE BETWEEN STEVE ROBINSON, W2FPY, AND J. GORDON BEATTIE JR., WB2CAM, VIA WA2SNA/R, OAKLAND, N.J.

FILE QST.82.02.28.0.K8MMO

TO: HANK,KA6M
FM: DAVE,K8MMO
SUBJ: VARIOUS

1. GLAD YOU GOT REPEATER CODE OK. SEEMED TO GO ON SYSTEM EASILY. MIGHT NEED REMOVAL OF ANY GARBAGE CHARACTERS PICKED UP. NOTICE THESE SOMETIMES AS SYNTAX ERROR ON LINE THAT LOOKS SUPER. I RE-EDIT THE OFFENSIVE LINE AND IT WORKS OK.

2. THE NJ GANG IS CERTAINLY THINKING. I HOPE THEY ARE WILLING TO ADHERE TO SOME STANDARD (NBS INTERNET GOOD) ON THE BACKBONE NET. THEY ARE REALLY INTO THIS GROUP CALLUP STUFF. I ASKED STEVE, IF I AM CONNECTED WITH PAUL, YOU WANT TO BREAK INTO MY CONNECTION WITH YOUR QRR TRAFFIC? HIS BOTTOM LINE WAS YES, IT IS MUCH MORE IMPORTANT THAN WHATEVER YOU ARE DOING WITH PAUL. AS LONG AS THEY KEEP IT LOCAL.

3. JUST GOT CALL FROM WB9FLW, PETE EATON IN ST. LOUIS. HE HAS BUILT A TNC BOARD AND IS STIRRING UP ACTION. HE WANTS A REPEATER PROM SO I AM SENDING HIM ONE. HE IS EXPERIENCING SLOW SERVICE OUT OF VANCOUVER.

73....DAVE

The following is my response to Dave Borden:

Dave,

Thanks again for the repeater code, and please pass along my congrats to the author for a job very well done. I have some great things planned for that program, and I think you will find the future impact greater than expected.

The program assembled and loaded ok, and seems to work just fine. The KA6M/R repeater will shortly be replaced by this code running in K6VCO's VADCG TNC, and the KA6M unit will be in the shop for upgrades and the installation of some internetting software.

The Pacific Packet Radio Society had its first "official" meeting on February 23rd. About 35 people attended. The most interesting piece of news was a move by a fellow in ALASKA to install packet radio on a widespread basis and to bring the place into the 21st century. There appears to be some development money available. He's already handing out APPLE/Communitree systems to various folks. More on this later as details unfold.

We were not given any official notice about the April 3rd meeting. Maybe I can get a VHS tape ready for presentation by then. Can't go cause I'm expecting a baby on April 15th.

We have exhausted the 32 station address space and are now opening up the second block.

Can QEX submissions be made through this medium? Does Paul see all these messages? Does he want things mailed in? Let me know.

73, Hank

FILE QST.82.03.04.0.VE7ADE

TO: HM
FROM: DML
SENT: 04 MAR 82 19:40:37
READ: 04 MAR 82 23:06:18

Hank,

Thanks anyways on the 8273s, then. The order has been in for some time now in Seattle, I hope, so it would be best to let it alone unless you need a quantity buy later on that we might both

benefit from.

Will call Don, VE7AOG, as soon as I'm finished here to have him send the bare boards. Unless Bob, VE7CYB, moves very quickly, the documentation will not be ready until later. Hopefully less than a week. I will put up a copy of the material list on here to help you get started in the meantime.

Cost is set at \$12 US. Could you tell me what your customs does when we send such boards down across the border? We've never heard anyone comment on it although I guess quite a few were sent from Bellingham. The boards were made in the States if that helps.

Thanks es 73,
John

+++++

Here is the 1200 baud radio 202 modem material list

120r	1/4w	R14
560r	1/4w	R27,28
560r	1/2w	R2,6,10,37,38,40,42
?		R20
4.7k	1/4w	R1,3,8
10k	pot.	R16,18,34
10k	1/4w	R15
18k	1/4w	R33
30k	1/4w	R17,25,26,30
47k	1/4w	R12
100k	1/4w	R21,22,31
470k	1/4w	R29
510k	1/4k	R32
2.2M	1/4w	R24

Capacitors:

1nf	C8
2.2nf	C16
10nf	C15
22nf	C3
27nf	C12
100nf	C5,6,7,11,13
150nf	C14
1uf 16V	C4
10uf 16V	C1,2,10,17,18
68uf 16V	C9

Diodes:

D1-D10 1N4148 or any small signal diode

Transistors:

Q1-Q7 PN3643 or equiv.

I.C.s:

U1 4069 CMOS hex inv.
U2 4528 CMOS dual MMV
U3 XR2206 vco
U4 XR2211 demod.
U5 4053 CMOS analog sw.
U6 LM324 quad opamp

LEDs: almost any LED will do. Current use:

DS1 squelch yellow
DS2 RTS red
DS3 TXD red
DS4 RXD green
DS5 DCD yellow

Let us know how the boards work.

CU, JOHN, VE7ADE

FILE QST.82.03.06.0.K8MMO

TO: HANK,KA6M
FROM: DAVE,K8MMO
SUBJ: HELP

1. WE NEED 8273s. We are all out here. I have 10 boards just received on consignment from Vancouver, but no chip sets. I just sold two and those guys need chips.

2. The latest packet newsletter suggests Doug's old gang is paying \$50 for them. That is what my supplier here suggests in plastic (\$73 in ceramic). If you want to go a 100 buy, I could help by taking fifty. Maybe it is time to push Intel on the offers?

3. Glad you like the repeater program. Jon, KE3Z does fine work. I am burning one for the St. Louis area tonight. They are a great way to get the city on the air. People hear the repeater and want to take part.

4. I finally received my \$17 CPU2 board from my friend in Texas. Sorry there are probably no more at that price. Anyhow, I will be interested in your internetting software. I am going to bring it up with a prom at \$E000 and 6116 ram (now \$7 per- back of Byte). Then, I will download programs to it from my "big" S100 machine.

5. You are having a baby? Could be good trick! Glad to hear about the development, but it could slow down your packet activity a little. The little ones do not sleep on our schedule.

6. Yes leave all QEX here. I read the mail, dump it to disk, call up Paul and dump it to him. He then edits it and prints final version on his printer which he takes to commercial printer who mails it out. All submissions are gladly taken.

73...Dave and the AMRAD gang

FILE QST.82.03.17.0.AA4KB

To: All packet stations
From: Fred Bray, KE6CD
Date: 16-MAR-82
Via: Mojo, AA4KB

San Francisco will be having its annual earthquake exercise on April 21, 1982. I am coordinating amateur radio involvement in the test. I would like to explore the possibility of setting up a few packet stations in various parts of the city to demonstrate its potential for emergency communications. If you are interested in working on the project, please leave a note in my mailbox on this system. \Golden Gate BBS -- (415) 863-7715}
TNX. Fred, KE6CD.

And I will relay replies, if there are any.

FILE QST.82.03.19.0.VE7APU

TO: HM
FROM: DML
SENT: 19 MAR 82 05:05:16
READ: 19 MAR 82 23:46:34

To whom it may concern:

I have another 'sked' with SM5HEV on Sunday, March 21. Jens will be using the call SK5EU which is the club station at the University of Linkoping. We will discuss the state of the 'Softnet' project at the Univerity.

We will try three different frequencies:
at 1500 UT on 14.178MHz
at 1515 UT on 21.220MHz.
at 1530 UT on 28.470MHz.

We will settle on the frequency that gives the best results but from past experience this is likely to be either 15 or 10 metres because 20 metres is usually very difficult.

Break in on CW if you want to join in the QSO and we will be glad to move up in frequency to the U.S. phone band.

Doug Lockhart, VE7APU/3

FILE QST.82.03.21.0.VE7ADE

TO: HM
FROM: JS
SENT: 20 MAR 82 22:16:26

READ: 21 MAR 82 19:50:23

Hank,

Sorry but the boards have not been sent yet. I still have to convince Don when I can catch him to send you the boards without the documentation. Al Mar is getting a final version of the schematic ready since Bob, VE7CYB is still pre-occupied with assembling and testing his 50 boards. He will still have to find time to put down the assembly instructions for everyone else who wishes to assemble their own. If you don't already have the EXAR spec sheet and apnotes, you might try getting them now for use when the boards arrive.

How is Packet Radio progressing in the Bay area? What sort of activities you have under way? As soon as we get the two pcb's under control I will be starting the process of adding a TNC to my ABBS so it will permit a mail drop function for the network. Also hope to use PR as a semi automatic long distance link for the ABBS telephone callers. (Thus starting the interesting debate of controlling third party traffic on PR.) What plans do you have for KA6M** along these lines?

If I haven't already given it to you, the VADCG ABBS is at 604 437-7001, 300 baud and starts up on DCD.

73 es cul
John, VE7ADE

FILE QST.82.03.25.0.N6ECT

Date: 25 March 1982
From: Curtis, N6ECT @PPRS:SFO
To: All Packet Stations

Copied exactly from the WESTLINK broadcast for amateur radio:

On Sunday March 7th, a group of Los Angeles based amateurs, NG6Q, KN6W, WA1ENX, and W6RFJ demonstrated packet radio to Dr. Robert Kahn, one of the primary developers of packet radio. Now what made this demonstration unique is that it took place in a Cessna 210 flying above the Los Angeles basin and in a van on the streets of Los Angeles. The four amateurs are all researchers at the Information Sciences Institute. An all assembled and multi-station packet radio system including a self-contained unit that can be used in a car, boat, or airplane. As Dr. Kahn was flown over the L.A. basin, this packet radio aboard the airplane was linked by 2 meters to a ground station at ISI.... ahhh but that's not the end of the story. The packet radio unit at ISI was connected to a computer network called ARPANET across the country to Arlington, Virginia, where Dr. Vince Cerf, an associate of Dr. Kahns', sat at home in front of his Apple (tm) computer. Now information sent from the airplane went to ISI via amateur packet radio from there onto Virginia via the ARPANET and then into Dr. Cerf's house via the telephone. In addition to being used as a

flying command post the station aboard the aircraft can also be used as an airborne store and forward repeater.

There you have it folks de Curtis N6ECT via KA6M/R

FILE QST.82.03.27.0.AA4KB

To: All PPRS Members
From: Mojo, AA4KB
Date: 27-Mar-82

I highly recommend the file ARRL_B26.TXT for reading. It is the league's official report of its semi-annual board meeting, and contains many things which may be of interest to all of us. Notable, of course, is the election of David Sumner, K1ZZ, as Secretary and General Manager of the ARRL. Having worked closely with Dave, I feel very strongly that they could not have chosen a better man for that job. He is known and respected internationally, and is a very bright, forward looking individual, besides being a world-class operator.

But also of more immediate concern to the PPRS is the board's decision to fight any amateur license without a code requirement. I believe that it is the general consensus of this group that a morse code test is not desirable for the growth of digital radio techniques. I have long been an advocate of CW, and it is still my much-preferred mode of operation on HF. But I also believe that a code-free "digital" license for VHF data communications is a desirable item in the FCC regulation structure.

I would like to see the PPRS consider at its next meeting adopting a resolution addressed to the ARRL and to our Pacific division directors urging them to reconsider their resolution at the last board meeting. I would also like to see the PPRS form a committee to draft a rule-making petition to the FCC for the adoption of a "digital" amateur radio license.

This letter is solely the opinion of the author, and does not reflect the policies of the PPRS.

Morris Jones, AA4KB

FILE QST.82.03.30.0.W2FPY

TO: HM
FROM: SER
SENT: 30 MAR 82 15:05:04
READ: 30 MAR 82 17:36:41

Hank -

Just a few thoughts about your LAN design discourse....

1. Overlapping domains: If the same frequency is used by all, this is just another extreme case of TDMA with high channel loading. We can allow it as long as channel efficiency remains high. I feel that the LAN should have its own HDLC address so that a terminal node can choose which of several LANs on frequency to make transactions with. After all, I may have several phone numbers at home and at work; there's no reason why I can't access several different LAN's by packet radio. The big question here is not the mechanics of TDMA or addressing within an LAN, but of how DX (multihop) traffic is passed in and out of the LAN. This brings up the concept of the "HOME NODE(s)". Something has to establish the terminal node as a member of the LAN(s). I would suggest that all users require a one-time-only login with the LAN in order to establish their addresses (Callsigns) with the LAN service directory.

2. Control stations for repeaters: I'll ask you the question! Can we get away with repeaters that aren't controllable by someone?? After all, how do we establish and maintain routing tables (I'm assuming the table-driven routing scheme)? I think software update of such tables is premature. I would like to see users (terminal nodes) with limited control over the LAN repeater services. For instance, ability to do call forwarding and call waiting, etc.

3,4, & 5. No contention.

6. Direct connections: Why? Why must we have protocols that handle the exceptions? If people want to handle transactions directly, they should probably go off net and off frequency, and use a different protocol (firmware switch). I don't think we should concern ourselves with exceptions like this.

7. No comment

8. Again, why can't we use a uniform exchange locally? If the processing overhead for an IP header (and transmission time) is not significant we should use it always! (I'm playing the devil's advocate here.....) Anyhow, WHO SUPPLIES THE IP HEADER??? The terminal node?? The LAN repeater service??? If you want to keep the TNCs small, you probably don't want to do too much work at this level. On the other hand, even the mightiest micros will be crushed by having to handle the translation from local to IP protocol for a large number of stations with 'DX transactions'.

9. Small number of hops, and use of IP versus non-use: In order to get away from the use of a big header for short hops, we have to carefully consider the network hierarchy (NOT TOPOLOGY). I will break here, and prepare a text on HIERARCHY for your perusal - then I'll continue with the commentary.....

73, for now
Steve, W2FPY

FILE QST.82.03.31.0.W2FPY

TO: HM
FROM: SER
SENT: 31 MAR 82 02:40:41
READ: 31 MAR 82 04:12:34

To: All Packet Radio Groups
From: Steve Robinson, W2FPY
Subject: 220 MHz FM transceivers

We have the opportunity to make a unique group purchase of a large number of 220 MHz crystal controlled FM transceivers. Ed Clegg, W3LOY, has been informed of the need for some inexpensive gear for use in packet radio. His answer to this need is the old Clegg FM-21 transceiver. The FM-21 is not very modern, but is all solid-state (including T/R switching), and has an output of about 10 watts.

Ed informed me that he has somewhere in the order of 500 sets of parts for the FM-21, in various stages of completion, from simple bare-boards & parts, to completed boards. The FM-21s have been "written-off" as saleable items, and will go at a small fraction of cost. Estimates are that they will cost anywhere from \$30 to \$60 each (complete), depending upon how many parts are in common with currently used stock (you know, tuned coils, etc. - they NEVER get out of date).

The bottom line is this - The rigs won't be sold by him one-at-a-time, but if we were willing to make a group purchase, he will fill the orders. If you want to get on 220 (for packet radio, of course), want to get on inexpensively, are willing to complete a partially completed commercial rig, and are willing and able to tune it up, THEN THIS IS FOR YOU.

Nothing has been firmed up yet. I would like an indication from all packet radio groups as to how many would wish to purchase rigs. If enough respond, I'll give that info to Ed Clegg, and we can negotiate the price. Please send a list of how many rigs and who they are for, and I'll follow up on this one. I'd be happy to supply more details on this deal, on request. Please DON'T confuse things by contacting Clegg directly - let me handle it as a group purchase.

73,
Steve, W2FPY

ps: Many thanks are due Rip, WA2LQQ, for initiating the search for inexpensive packet radio RF gear....

FILE QST.82.04.01.0.KA6M

Date: April 1st, 1982

From: Hank, KA6M
To: All Packet "C" Freaks

Several packeteers have mentioned the possibility of using the programming language "C" as a good choice for implementing higher level protocols. Would like some response on these questions:

1. What 8080/Z80 compilers are out. I know about BDS, Whitesmith's, and derivations of tiny-C. Any others? How well do the above work?
2. Any experience in linking the code generated to assembler and putting the whole thing into ROM?
3. How do you foresee using C? As part of a combined CP/M-VADCG system?

Any input would be appreciated. Thanks.

73, Hank

FILE QST.82.04.01.0.W2FPY

TO: HM
FROM: SER
SENT: 01 APR 82 23:09:21
READ: 02 APR 82 00:55:48

Hank,

I have a list of C compilers available for various microcomputers; I'll put this on here at a later date... In the meantime, I have recently discovered that there is a tape available from Berkeley that runs in the UNIX V7/Berekeley UNIX environment. This tape contains a full-blown C compiler, plus the utilities needed to compile and optimize native code on all the popular 8-bit micros (noteable exception, the 6502), and several 16-bitters. Needless to say, I'm getting a copy of this to run on my UNIX system at work.

Typically optimized C programs occupy about 30% more storage than equivalent typical assembly language programs. The execution times vary with the nature of the benchmark, but communications programs are generally very fast. The benchmark we will use in NJ will be to rewrite the TIP and LIP software in C, and see if we can stuff it into the VADCG TNC memory space (Grunt!!!). This reminds me... Since some of PASCAL can be translated into C code (both are pointer oriented languages), do you know of any documents stating the link level 2 in PASCAL defines? This would save a bit of work!!!

73, and more on C later...
Steve, W2FPY

FILE QST.82.04.03.0.VE7ADE

TO: HM
FROM: JS
SENT: 03 APR 82 19:18:38
READ: 04 APR 82 00:41:23

Hank,

The project I am involved with at work is a unit similar to the TNC board but with four async ports and X.25 on the line side. I am looking after the hardware design so I am not yet much concerned with the high level software which is in C. The programmers are still looking around for compilers and linkers to achieve exactly what you are considering. The C source is currently on a PDP 11/70 and will be switched over shortly to a VAX, both under UNIX. The compilers, etc. will be run on the VAX. There were several other names of software vendors we found but I'm not sure if they would be much use to us since the packages are probably meant only for the larger machines.

If the source code you came up with were compatible with the compiler we settle on I'm sure it would be possible to run it through up here. The problem of course would be in shipping the files back and forth during debugging. I'll get the vendors' names in case they are any use to you.

73 es cul
John, VE7ADE

FILE QST.82.04.04.0.AA4KB

To: All packet stations
From: Mojo AA4KB/6
Date: 04-APR-82

This message received on CompuServe HAMNET today:

#: 3674 Sec. 9 - RTTY/PACKET PEOPLE
Sb: RTTY/PACKET RADIO
 04-Apr-82 12:09:38
Fm: Jim Jones WB9QZN 70050,201
To: ALL

Packet Radio is getting started in Chicago, W9SKD and myself WB9QZN (VQ9JJ) are working on getting something work up. Right now Dick (W9SKD) is getting an RTTY BBS going. This is running under CP/M, using a modified version of BYE75 and RBBS. We are using my BBS as a clearing house for Packet Radio information. The phone number is (312) 759-7005. Voice (312)759-4747. The BBS will accept 300, 450 and Ma-Bell 1200 Baud rates. If the phone rings more than once, then I'm using the computer. Most times I get the BBS up by 11 pm CST. I will try and check into here at least once a weekend.

73's Jim WB9QZN

FILE QST.82.04.07.0.KD2S

TO: HM
FROM: DC
SENT: 07 APR 82 08:24:13
READ: 07 APR 82 16:02:25

TO ALL PRNET MEMBERS

The Tucson Amateur Packet Radio group has started the alpha test phase of the TAPR terminal node controller today....

Our first dozen printed circuit boards are finally here, along with all of the necessary components. Cost for the TNC with integral modem and power supply is \$125 ! We should be able to keep well below \$200 in a complete package, including connectors, cable and fancy box...

I expect many weeks of wrestling with FORTH software and PROMS before the boards will be speaking both TAPR and Vancouver protocols, but we should have something to show st the SW ARRL convention in early June.

We won't release the wave-soldered, pre-tested beta boards until we are sure of the hardware and software, so I'll keep all informed of developments...

73's

Den KD2S

FILE QST.82.04.07.0.W2FPY

TO: HM
FROM: SER

Hank,

Sorry for assuming that you knew about the FM-21 - It is a relatively old rig. Here is an abstract of the specs from the users manual:

GENERAL DESCRIPTION

The Clegg FM-21 is an all solid-state VHF Transceiver designed for reliable two way FM communication in the amateur 220-225 MHz service. Use of recently developed MOSFET amplifiers and mixers combined with the latest in integrated circuits and monolithic filters yields performance comparable to that expected in the lower frequency bands. An exclusive feature of the FM-21 is the CRYSTAL SAVER technique which permits use of a single channel crystal for both receive and transmit in SIMPLEX and REPEAT modes. A single channel crystal suffices for three functions:

- 1) Transmit on Repeater input frequency
- 2) Receive on Repeater output frequency
- 3) Receive on Repeater input frequency

This multiple receive frequency capability will be of special value to Repeater control stations and implements compliance with provisions of FCC Docket 18803.

The FM-21 is designed for mobile operations from standard 12.6 VDC (negative ground) vehicular systems. Current consumption is sufficiently low to permit "cigarette-lighter" operations. A convenient mobile mounting bracket is furnished with the FM-21. The unit will perform as an excellent base station when used with an external power supply.

The FM-21 is factory wired for 6 channel operation. Up to 5 additional channels may be readily added with an inexpensive modification kit. Crystals for the CRYSTAL SAVER can be furnished directly from the factory where a stock of all proposed channels is maintained, or from most Clegg Distributors.

Note: The sample FM-21 obtained from Clegg did not have a mobile mounting bracket or microphone. The CRYSTAL SAVER crystals were furnished, as were crystals for 222.98, 223.34, and 223.50 MHz. The power connector, also not included, was readily obtained from Radio Shack. The unit supplied required extensive tuneup to make it operational. A factory preparation "manual" was supplied for this. I believe the minimum instruments needed to do a proper tune-up are a frequency counter (good to 220 MHz), and a high-impedance voltmeter (reading in the millivolt range). A dummy load should also be included in this list. Weak signal sources could be had by loosely coupling a signal from a local repeater to the coax connector. - W2FPY

SPECIFICATIONS

Receiver

SENSITIVITY:	.25 uv (MAX) for 12 db SINAD
SELECTIVITY:	Adjacent channel (40 kHz) down 50 db
SPURIOUS REJECTION:	All down 60 db
AUDIO RESPONSE:	300 to 3200 Hz; Standard EIA characteristics
AUDIO POWER:	1.5 watts at 10% THD to internal or external speaker

SQUELCH: Noise acuated, adjustable threshold.
.2 to 2 uv min. range

MODULATION ACCEPTANCE: +/-6 KHz

Transmitter

POWER OUTPUT: 8-10 watts (at 13.5 VDC)

MODULATION: PRE-EMPHASIZED FM with Deviation
adjustable from 0 to 7 KHz. Adjust-
able speech clipping up to 10 db

SPURIOUS OUTPUTS: 2nd and all higher harmonics down more
than 50 db all non harmonic related
outputs down more than 46 db

OUTPUT IMPEDANCE: 50 ohm nominal. Output stage inherently
protected for infinite VSWR

MICROPHONE: Noise cancelling PTT High Impedance
Ceramic (Supplied with Unit)

General

FREQUENCY RANGE: 220 to 225 MHz
222 to 225 MHz to full spec.
Power output down less than 2 db at
220 MHz

FREQUENCY STABILITY: +/- .001% from 25 to 100 degrees F
+/- .0025% from 10 to 125 degrees F

PANEL CONTROLS: Channel Selector
Squelch Threshold
Volume
Mode: 1. OFF 2. SIMPLEX 3. REPEAT

FREQUENCY CALIBRATION: +/- .001% at 25 F with properly specified
Clegg crystals. * No calibration
adjustment or netting required.

NUMBER OF CHANNELS: 6 crystals positions standard.
CRYSTAL SAVER provide for each crystal:
1. Transmit Channel
2. Receiver on Transmit Channel
3. Receive 1.6 MHz ** above Transmit
channel

(PC Board and Channel switch has pro-
visions for up to 5 additional crystal
positions)

POWER REQUIREMENTS: 12 to 14.8 VDC
STANDBY CURRENT 120 Ma
RECEIVE CURRENT 450 Ma
TRANSMIT CURRENT 1.3 Amps

DIMENSIONS: 7" Wide X 2 3/4" High X 9" Deep

WEIGHT: 5 lbs. including microphone & mobile
mount

Note: Factory tuneup sheet specs RX sensitivity at 0.35 uv for
12 db SINAD. TX spurs speced at -33 db. - Beware! - W2FPY

Applicability for wider band use or direct FSK, etc. RX
IF frequency is 41 MHz (1st IF) and 10.7 MHz (2nd IF). RX uses
monolithic crystal filter, and will be VERY broadband if filter
removed or replace with wide-band unit. TX looks like it can run
much wider-band deviation with little adjustment. The FM
discriminator is a CA3075. It seems serviceable for higher bit-
rates. The PC board is large, with very "open" construction.
This should make all "mods" simple.

The local RTTY group, here in NJ, says that there was a
standard modification for using these rigs for AFSK. Basically,
it involves injection of high-level audio to pin 1 of IC4
(MC3301). This leaves the mike-line available at all times.
Similarly, you can tap audio off the speaker line, and leave the
speaker on (your option!) at will.

Folklore here also says that the FM-21 is a poor mobile
rig, due to temperature/stability problems. Therefore, it would
not make a good RF deck for a digipeater (unless kept at home).

I hope this satisfies your curiosity! I can supply more details
about this rig as needed. Ed Clegg (W3LOY) is anxious to sell
out his entire stock of parts for the FM-21, and this might
include many spares, etc. He suggests that, if we don't need the
box, he could simply supply completed and partially completed
boards (one PC board for RX and TX). Incidentally, T/R switching
is solid-state, too.

PLEASE BE AWARE!!! I don't know how many of these rigs are
complete. Ed says he will be able to supply anything needed to
finish them, but he still hasn't filled me in on how-much-of-what
is in his warehouse. It is likely that some parts will have to
be stuffed onto the PC board to make it operate. You will
definitely have to do the tune-up.

Happy reading & 73,
Steve, W2FPY

FILE QST.82.04.08.0.KD2S

TO: HANK
FROM: DEN

WE ONLY BUILT 12 BOARDS FOR TESTING, BUT HAVE APPROXIMATELY 200 ORDERS, SIGHT UNSEEN, FOR BETA TEST BOARDS. TAPR SOFTWARE FOR HARDWARE TESTS WILL BE READY NEXT WEEK TAPR HARDWARE INCLUDES POWER SUPPLY & MODEM ON BOARD...JUST PLUG IT IN. TAPR SOFTWARE PROTOCOL DUE ON PROMS IN EARLY MAY (NOTHING COMES QUICKLY) VADCG SOFTWARE DUE IN EARLY JUNE (WOULD LIKE TO TALK TO YOUR BOARDS AT THE SW CONVENTION!)

YOU AND THE NJ,LA,ST LOU,AMSAT & LITTLE ROCK GROUPS ARE ON THE TOP OF THE LIST FOR BETA BOARDS, WHICH WILL BE READY BEFORE THE SOFTWARE....73, DEN

FILE QST.82.04.08.1.KD2S

I told Den that he shouldn't hold up distribution of the TAPR boards until they complete their software, a project that might take a while. I felt that other people might want to write their own software for the units. Here is Den's reply:

HANK,

I AGREE WITH YOU ABOUT THE OTHER WORK THAT COULD BE DONE. I WILL GET THE BETA BOARDS OUT AS SOON AS THE ALPHA BOARDS ARE SHOWN TO EXHIBIT NO FATAL FLAWS. GIVE US ABOUT A WEEK TO TEST THE HARDWARE WITH SOME PRIMITIVE ROUTINES, THEN SOME TIME FOR A LAYOUT-MODIFICATION CYCLE. I COULD TRY TO DELIVER BOARDS SOONER THAN JUNE THAT WAY.

I'LL SEND YOU A LONG FILE ON THE CURRENT HARDWARE CONFIGURATION FOR YOU TO PASS AROUND, AND WILL GIVE YOU A "LAYERED LOOK" AT THE DYNAMIC ADDRESSING PROTOCOL, CONNECTIONS TO IP, ETC. A LITTLE LATER ON. 73, DEN

FILE QST.82.04.09.0.KA6M

Date: 09 April 1982
From: Hank Magnuski, KA6M
To: Steve Robinson, W2FPY
CC: Paul Rinaldo for AMRAD or QEX bulletins

Re: Zilog Z8530 SCC

There is yet another HDLC chip on the block, and this newest entrant looks like the best chip I've ever seen. It seems particularly well suited for amateur radio applications, and I wanted to bring it to the attention of all people thinking about designing TNC's or controllers.

First, some info straight from the spec sheet:

ZILOG Z8530 SCC SERIAL COMMUNICATIONS CONTROLLER

* Two independent, 0 to 1M bit/second, full-duplex channels, each with a separate crystal oscillator, baud rate generator, and digital phase-locked loop for clock recovery.

* Multi-protocol operation under program control; programmable for NRZ, NRZI, or FM data encoding.

* Asynchronous mode with five to eight bits and one, one and one-half, or two stop bits per character; programmable clock factor; break detection and generation; parity overrun, and framing error detection.

* Synchronous mode with internal or external character synchronization on one or two synchronous characters and CRC generation and checking with CRC-16 or CRC-CCITT preset to either 1s or 0s.

* SDLC/HDLC mode with comprehensive frame-level control, automatic zero insertion and deletion, I-field residue handling, abort generation and detection, CRC generation and checking, and SDLC loop mode operation.

* Local loopback and auto-echo modes.

* Z-bus daisy chain interrupt hierarchy is supported.

* Z8530-PS is 40-pin plastic package, single +5 volts required. 1-9 = \$53.70, 10-99 = \$44.80

The price may seem high until you consider that this one part can replace the 8273, 8250 and 4024 on the VADCG, or is the equivalent to two 8273s in gateway service. The part uses a non-multiplexed bus, has full DMA control, and should work well with many popular 8 and 16 bit microprocessors. There are three bytes of receive FIFO, software changeable Baud rates, many options for clocking, and even a method for handling Manchester encoding! Programming this thing won't be particularly easy, but shouldn't be much more difficult than the Z80/SIO or the 8274. The product specification is quite complete, and I advise all you circuit designers to have a look.

73, Hank

FILE QST.82.04.09.0.KD2S

CC: HM LSK SER PLR DML JS WWP DC

To: Hank

From: Den

I received the manual this afternoon, and will no longer be sending you copy with errors!

On installing components in the TAPR board, we have found a few problems:

there is one line shorted to a connector pin (easily fixed)
several components are closer to each other than they have to be one component (the crystal) shorts out a resistor if pushed too far onto the board a capacitor prevents a voltage regulator from being inserted into its holes

Nothing bad enough to prevent the boards from working, but we will be reshooting the board as soon as it tests out.

I am willing to do two things to get boards up to you:

1) once my board tests ok, I am willing to go silent for a while if you would like to see the board delivered to you.

2) I will send you several wave-soldered, tested, beta-level (re-worked) boards with just the hardware test software and a primitive TAPR protocol on PROM, so that people will be able to experiment. I have no qualms about your burning VADCG software and using these boards without any TAPR protocol in them, but I must know the board is working from a hardware point of view before it is sent out. I have spoken now to over a dozen owners of VADCG boards who have each told me a story about how hard it was to get the board on the air, and I would like to avoid that with our boards if possible. There is nothing to prevent a ham receiving a working board in the mail, if we are careful and check all boards before mailing.

I will try to check into this prnet daily over the weekend. I have begun to write the protocol specifications for the TAPR protocol. The only differences in our protocol from a fundamental point of view is the dynamic addressing and lack of modem (just transceiver) turnaround. The addressing is the driving force for a net control station, and the existence of this station allows other functions to be incorporated, all on what I would consider to be level 3a, the interface between IP and the HDLC. The linking schemes mentioned to date in the AMRAD newsletter are just link server protocols, residing in the level 3 protocol, and not meant to be used for what I would call true inter-netting.

I will leave a copy of the protocol specification in a public file here for general perusal in two weeks, when our first revision of the software is done.

Talk to you later

73, Den

FILE QST.82.04.09.0.W2FPY

Hank -

No action needed on the WD250-Bs. I suspect, due to the "uniformity" of the glitch, that there may be timing differences between the WD and National parts. I spoke with a National sales engineer (not mentioning this problem), and he said that there were somewhere in the order of thirteen (!!!) one- shots on that chip, and that the early versions (of National's part) had timing problems that were temperature-sensitive.

The track-record on the National INS8250 has been very good, so far. We purchased 25 of these for stuffing the VADCG TNC boards. No funny symptoms in the entire lot.

It may be appropriate to alert some of the other groups about the possible problem. The date code on the "funny" WD8250-Bs is 8015. To the best of my knowledge, this problem hasn't cropped

up with other lots.

Received your request for the FM-21s. I'll keep you posted on the status of the deal with Ed Clegg. We have had many problems running packet radio on 2-meters in the NYC/NJ area. Seems that people treat frequencies as personal territory!!! It makes a lot of sense to expand into the 220 MHz band. One of us (AD7I/2) is experimenting with direct FSK on 220. This brings up a key question - How fast will the TNC boards run when using your style software?

From an engineering standpoint, the lack of adequate buffering on the 8273 is a big headache. I suspect that transmit frame underruns and receive frame overruns will result if we push the speed to the hardware limitations of the 8273. That chip is meant to run in a DMA environment (where its performance is excellent. New designs for TNC boards here, and in other areas, have been considering the Zilog SIO (which is quad-buffered) or the Motorola MC6854 (triple-buffered). Both chips require an external DPLL, but this is traditionally the function of the modem! The clock recovery can be accomplished with a single chip. I guess we could still use the 8273, and install a hardware FIFO in the RX and TX data (buss) paths.

Again, the existance of hardware variants of the TNC board underscores the need for a high-level language approach to packet radio software.

Time for me to get off the soap-box. 73 for now! - Steve

FILE QST.82.04.11.0.KD2S

To: Hank
From: Den

We've put three more of the Alpha boards together today, bringing to five the number of completed boards, with two more to be finished later this weekend. Our optimistic predictions still show:

Alpha proof-of-performance	-	2 weeks	(WA7GXD)
Beta layout	-	3 weeks	(NOADI, KD2S, WB7ESQ)
Beta PC boards (ass'y, test)	-	6 weeks	(WA7GXD, KD2S)
TAPR TNC (turnkey!)	-	10 weeks	(AG7H, WA7PXW, Baker)
TIP software	-	DONE	(WA7PXW)
LIP software (primatives)	-	3 weeks	(N7AIG, WA7PXW)
NCS software	-	4 weeks	(KD2S)
TAPR LIP	-	6 weeks	(WA7PXW, N7AIG)
VADCG LIP	-	6 weeks	(KC7MA, KD2S)
TAPR/VADCG (auto interface)	-	10 weeks	(NOADI, WA7PXW, KD2S, KC7MA)

We have a great deal of information on the VADCG/AMRAD station and digipeater protocols, but would like to have the current version of protocols in use at your site. This information will allow Margaret, Chuck and myself to be operating on correct

information. I will send a copy of this request to other groups.

Incidentally, I spoke at length with Pete WB9FLW, our "Beta test coordinator" in St. Louis. He was very happy that all three Vancouver boards being used to demonstrate packet radio there worked the first time they were turned on ! This is the kind of thing that will convince people that packet radio is coming of age.

Thanks for your help.

73, Den

P.S. I will speak to Rip Monday to pass information on the AMSAT modulation schemes, and to get the transponder performance data. We're also getting an L-band exciter and power supply to test our L-band transmitter project, which now has the backing of the University of Arizona E.E. Department.

FILE QST.82.04.13.0.K6HWJ

Date: 13 April 82
From: Cal K6HWJ
Subject: Clegg FM-21's
To: Hank KA6M

I just talked to Lance Ginner, K6GSJ, about his experiences with the Clegg FM-21's on the YCZ 220 MHz repeater. His advice was not to touch them with a 10-foot pole. Apparently there was a group purchase of (commercially built) units a few years back, and they all required considerable reworking to make them useable for the 220 repeater. I think the final output transistors kept blowing up. You might want to talk to Lance yourself to find out first-hand just what the problems were. It sounds like the "kit" form would not be very suitable for those members who aren't RF experts.

FILE QST.82.04.15.0.AA4KB

ARRL BULLETIN NR 32 FROM ARRL HEADQUARTERS NEWINGTON CT
APRIL 8,1982 TO ALL RADIO AMATEURS BT

At an Open Agenda meeting on April 1,1982, the FCC eliminated two sections of the Amateur Regulations, as part of an ongoing review of rules to prune out those which are no longer necessary. Section 97.71 required an adequately filtered DC plate power supply for transmitters operating below 144 MHz. Section 97.74 required a means of measuring frequency independent of the transmitter itself. Cancellation of these two rules represents a change in regulatory philosophy from how to observe the rules to what the results should be. Other rules still in place require that an amateur signal be clean and that it be in band. The same meeting adopted a Notice of Proposed Rulemaking which would provide for new frequencies for model control in the 72 to 76 MHz

range

AR

FILE QST.82.04.15.0.KD2S

To: All groups

From: Den

Tonight Lyle Johnson WA7GXD successfully tested the terminal interface hardware of the TAPR TNC. This weekend's goal is to have the radio interface also tested. The 6502, RAM, PROM and serial port do seem to operate as expected, using a few assembler routines that Lyle burned into one of the PROMs.

The software group met again, and the parsing of VADCG tasks among members was accomplished. The beta test boards will attempt the following interface tasks:

1) TAPR board in a VADCG net...

Upon signing on and not receiving an I.D. from a TAPR NCS, the board will try to send a VADCG packet. If acknowledged (repeated), the board will either

- a) use the coordinator-supplied VADCG address word installed in non-volatile RAM by the user, or
- b) try sending messages to high-numbered boards, and use the first available address it finds.

2) VADCG board in a TAPR net...

Upon hearing a board with a VADCG packet format, the TAPR net control station will immediately assume a digipeater role, if not already doing that, and translate each VADCG packet into TAPR format.

I am interested in knowing the best algorithm to use to find unused VADCG addresses in a network. Should I look for high or low addresses first? Telling the difference between TAPR and VADCG packets is easy, since the number of address bytes differs (one vs. two).

More information will be forthcoming as the alpha tests progress!

73, Den KD2S

P.S. There will be an Alpha board at the Dayton hamfest. We will send a debugged board up to Pete Eaton WB9FLW, who is organizing a special Friday night packet radio get-together in Dayton. I will relay more information as Pete calls each packet group.

FILE QST.82.04.15.0.VE3QB

Hank, KA6M

Re K6HWJ's input in FM21's. We locally bought a bunch of these units about 2 years ago and not one has failed under reasonable service. We have them running 24 hours per day under link

conditions and the only failures have been in the Antenna Relay which wasn't designed for continuous service anyways. One of our Packet Radio people, Ted Baleshta has developed a PIN diode switcher for the relay and the units are being used in PR service in Montreal and Ottawa. This in no way disputes the K6HWJ input - it merely reflects our experience. A message from you to Ted might get him to write up the mods for the PIN diode. Regards

de Larry VE3QB

FILE QST.82.04.15.0.W2FPY

Hank -

Although the FM-21 is not considered a "clean" rig, I do disagree with the statement that they are not useable by other than RF experts. There are a good many in use in NJ which have survived the years.

As I stated previously, the FM-21 is not suitable for service as a repeater. It suffers from oscillator stability problems. It is however a very serviceable rig for use on a single channel indoors.

The FM-21s coming from Clegg will DEFINITELY require tuneup! If you feel that this factor will prevent a number of your users from getting them on the air, please say so. We intend to have a 'tuneup' party here in NJ to get all our units on the air.

As far as finals blowing out, the manual states that the output is protected against infinite SWR. After looking at the schematic, I must disagree with the manual; the final transistor could be cooked by running 'key-down' for a while into an open or shorted line. I tried a little experiment with mine. I ran it for 30 minutes straight, into a 50 ohm dummy load. Power out was 12 watts. The final and heatsink was VERY warm after this maneuver, but you COULD hold your hand on it. I then tried to run it into an open line (25' of RG8). This operation REALLY heated the final rapidly. The final transistor was too hot to hold my hand on, after only three minutes. However, nothing burned out!

Do you anticipate sending packets as long as 3 minutes into an open or shorted line? Do you anticipate sending packets as long as 30 minutes into a proper load? Aren't we really talking about a very low duty cycle? ---- Point made?

73, Steve

ps: Do you still want the FM21s, or should I cancel? - S

FILE QST.82.04.20.0.W4RI

Dear Hank,

In re: AMICON Interim Standard

This represents AMRAD's thinking toward the AMICON interim standard that you are now drafting. It also gives you our thoughts on local area and backbone networking issues.

Communications Channel

We have no problems with the ideas expressed on the telecon. Virtually everyone who is active on packet radio today is using the VADCG TNC, Bell 202 modems to afsk a vhf-fm transceiver with 5-kHz deviation and about 15-kHz rf bandwidth. Unless we stick with these parameters for the communications channel, the packet people will be hard-pressed to reconfigure by the time that Oscar Phase III-B is launched. It is a bit wasteful of bandwidth (as opposed to fsk), but that is a trade-off to allow people to use their present equipment.

Physical Level

There do not appear to be any issues at this level. Everyone in North America is using RS-232-C, and others may use X.21.

Link Level

The link level protocol, in our view, is essentially noncontroversial, at least to the extent that there appears to be a consensus for using HDLC. The main issue here is addressing. There may be some issues concerning the control field, but these are secondary and can be deferred for now.

Dynamic vs. Static Link-Level Addressing

We are fundamentally opposed to dynamic addressing at the link level. One of the strongest reasons is that each individual amateur packet radio station should be able to come on the air at link level and use his TNC board to connect without having to check into a particular network controller to find out his address. He already has one (his call sign), and we see no reason to avoid using it for link-level addressing. This permits an anarchistic mode of communications, and permits operation whether or not there is a network controller present. The ability to communicate after loss of a network controller is vital to emergency communications. It may be key to our being able to stay on the air after a nuclear attack. (Right now, that's against the law. The case is being made now to the DoD that Amateur Radio can survive and that the law should be changed to permit post-attack operation. If the packet net is designed to survive, we have some chance of getting some DoD funding. In our view, the prospects of DoD funding are not at all certain and should not be the driving force.)

The details of our argument for static call sign link-level addressing and against dynamic addressing are spelled out in Terry Fox's article, "Level 2 Protocol Proposal," which appeared

in the AMRAD Newsletter for March 1982. This article had only terrestrial packet networking in mind. There are even stronger arguments for static link-level addressing for satellite and hf links. The satellite's moving footprint complicates both addressing (if done dynamically) and handoff from one net-control station to another (there dynamic addressing would be just one more part of the complexity). At hf, the propagation medium is changing so rapidly as to seriously question the feasibility of net controlling at all (it would be further aggravated by dynamic addressing). These problems are eliminated by static call sign addressing at the link level.

The call sign approach will allow a user to move around several networks freely without having to worry about addresses each time. Even if he moves from a local 2-meter network to an hf link with a buddy three thousand miles away, the address won't change.

There are two important things that should be added to the March article. One is how the "request-to-repeat" and "repeated" bits fit in. The other is that we are no longer thinking only in terms of having only the call sign of the transmitting station in the HDLC address field -- it changes according to circumstances, talked about below.

In this address scheme, the letters of the amateur call in the address field are forced into upper case, which uses 6 bits per character. If we assign the request-to-repeat bit to the first octet of the address, and the has been repeated bit to the second octet, there is more than enough room. This would also allow us up to 5 other bits (one spare bit per octet) for future expansion.

While at first, we were considering using only the call sign of the sending station (not necessarily the source, as in the case of relaying). We heard arguments which said that we should use the call sign of the intended receiving station. That argument ran like this: If you are transmitting on a frequency which has repeaters to the West, North and East, all repeaters may repeat the packet if the sending station's call is sent. This could be eliminated by substituting the call sign of the intended receiving station (repeater in this case). Terry has been working on a more complex scheme which sometimes uses the call of the sender and the receiver, according to whether balanced or unbalanced modes are being used. More on this in the near future.

In the opinion of most network designers, the link level is not the place for other functions, such as device selection within each user, multi-user hookups, or how to route the data thru the system. It has enough to do just maintaining the data link reliably between two points. The above functions are for the higher layers. Therefore, we recommend that we use a version of HDLC called ADCCP. This is very similar to what we are using on the air in most of the country with the VADCG TNC board.

Hf is probably a special case. We would like to use HDLC to the extent possible. But, link reliability would be poor. We need a combination of ARQ and FEC (forward error control) protocol. We envisage a special board (similar to the TNC) for hf packet links. This subject will be developed later. Clues to our thinking are in the hf standards section of Paul Rinaldo's paper in Volume 1 of the proceedings of the ARRL Amateur Radio Computer Networking Conference, October 1981 and in AMRAD VuGraphs 82-31, "Proposed Packet HF Channels," and 82-32, "Rx for HF Packets."

Network Level

The network layer has often been divided into two sublayers, called the "network" sublayer, and the "internet" sublayer. The first is responsible for maintaining control over a group of links, while the internet layer is used to send data back and forth between these individual networks.

Network Sublayer

The network sublayer (called by NBS layer 3A) is responsible for maintaining the individual link connections from the link layer, and it is also responsible for routing the data from the sender to the proper receiver(s). Since there can be several link level connections going on at once, there is the potential of overloading the network with data. A system similar to level 2's flow control is used at the network level to make sure the network doesn't get overloaded.

The network layer is also where group connections can be made.

After a lot of research, and talking to several people in the networking field, we recommend that the amateur packet community use the X.25 virtual circuit standard at the network sublayer of layer 3. Usually the individual networks will be reliable enough to support a virtual circuit system, such as X.25. We do not envisage use of the datagram provision of X.25; no one else is using it either. (X.75 would apply to the AMICON. For hf, we feel it unlikely that a network sublayer protocol is either needed or practical. This will be left to separate study.)

Again, we recommend static addresses. The X.25 format calls for 14 quartets (semi-octets), BCD encoded with A-F not used in the current version of X.25. That forces us to encode call signs in their decimal equivalents; i.e., 2 decimal digits per letter in the call sign. (This is something that could change in X.25, opening up a future possibility of something a bit more elegant here.)

Internet Sublayer

The internet sublayer (called layer 3B) is used to connect the individual networks together so data from an individual on one network can be sent to someone else on a different network. This layer is NOT used instead of the network layer, but rather in addition to the network layer. It creates its own headers, and has separate information from the network sublayer.

We recommend use of the NBS Internet Protocol. We do this while realizing that the NBS IP is subject to change on its way to become an ISO standard.

Again, we recommend that static call sign addressing be used at the Internet level. Unfortunately, the format has to be different from those used at the link and network levels.

The call sign is good in one respect - it's unique. It's poor in another - it doesn't designate the location. So, just the call sign would identify the entity but not where it can be found. A look-up table would be theoretically possible, but it's not practical to have every network node keep a table of every ham in the world, where he is, and how to route to him. In fact, most everything in print says that imbedding the routing in the address is a mistake - it ties that location to a given routing unless alternative routing schemes are devised.

So, a good address would include two elements:

- (1) who (unique to the host ham station), and
- (2) where (unique designation to the area).

That's crowding things to get both of these things into the NBS Internet address field, but it can be done.

The NBS Internet address field consists of 64 bits overall. These 64 bits are subdivided as follows:

The first 16 bits comprise the Digital Network Identification Code (DNIC), further broken down as follows:

4 bits: Zone (continent or ocean)

8 bits: Country (each country has one or more country numbers - the U.S. has 3 now)

4 bits: Network (assigned by the country authority - the FCC in the U.S.)

These 16 bits are organized into BCD quartets, corresponding to the digits 0-9; A-F are not used. The rules for the above DNIC scheme are governed by CCITT X.121.

The remaining 48 bits are terminal addresses and are to be assigned by the specific network.

Assuming that we want to be compatible with the NBS Internet Protocol and its address structure, we could go to the FCC and ask for the assignment of a DNIC for the worldwide Amateur Radio packet network. That would be one international DNIC for hams. The alternative would be to have each Radio Relay League go to their respective telecommunications authorities and get one for each country's Amateur Radio service. That alternative doesn't make a lot of sense in that it can be expected that some countries will assign a DNIC, but most will not.

In any event, the DNIC is assigned by higher authority. We (as a network) need only concern ourselves with how to allocate the last 48 bits.

The call sign, as a unique identifier for a host ham station, would be worth considering as something to put in the 48-bit address field. If one organizes it into octets, it would take 6 octets for the call sign. That would take up all 48 bits just for the call sign. This is not acceptable because we also need to encode location as well as call sign.

Is it the thing to do to extent the 48 bits to whatever is needed for the call sign and whatever else is required? We don't think so, because we've violated the NBS Internet Protocol and done so without much justification. Also, that would contribute to additional overhead which is universally frowned upon.

Can the call sign be made to fit? Yes, thanks to the organization of the ASCII code. Amateur Radio call signs consist of up to 7 characters. The first two characters can be either figures or letters. The third character is always a figure. The suffix of one, two or three characters is always literal. For shorter call signs, the spaces not occupied by a letter or figure are nulled. By knowing in advance the most-significant bits of the ASCII characters used in the call sign, we don't need to transmit them. That permits the following number of bits to be used:

Example call sign:	W	D	4	I	W	G	
Bits required	:	6	6	4	5	5	= 31

This leaves us (48 - 31 =) 17 bits to play with.

These 17 bits are sufficient to accommodate a 1 degree by 1 degree grid system over the entire earth. 8 bits are needed for north and south latitudes (8 bits provide 256 possibilities, while only 180 are needed). 9 bits are needed for east and west longitudes (9 bits provide 512 possibilities, while only 360 are needed). Stations would use the integer degrees of longitude and latitude, not round off. Those stations above (say) 32 degrees latitude would use only even longitudes. This would make us compatible with the European QTH system, and it would be possible to translate back and forth.

There is much more to talk about. We don't have the time to write more until after Dayton. We haven't discussed the Transport level, which is the level that generates/breaks down the datagrams at the Internet level.

Dave Borden is out of the country for a few weeks, but we went over this prior to his departure. We also had an opportunity, at the Trenton Computer Festival last weekend, to discuss much of this with Steve Robinson but mainly in the context of the East Coast terrestrial network. We think that Steve's thinking and ours are very close and that we can resolve the remaining differences and misgivings at our next meeting with him.

73.

Terry Fox, WB4JFI

Paul Rinaldo, W4RI

FILE QST.82.04.20.1.AA4KB

TO: All interested packet stations
FROM: Mojo, AA4KB/6
DATE: 20 April 1982
RE: Digital Phone Patching

For some time now, I have realized that my unique system for packet controlling allows me the option of having a remote terminal controlling my software. The hardware and software for the TRS-80 packet terminal node does not use the available serial port on the TRS-80, making it available for connection to a remote terminal or modem.

This past weekend I demonstrated this capability. Peter Strauss, K06R, connected to my system as a terminal (my system functioning as host) via 300 baud modem and the switched telephone network. From his terminal he was able issue commands to my software, and conduct a QSO with N6ECT and login to KA6M**.

I'm not sure of what value this demonstration might be to the network as a whole, but it was certainly fun. It may be useful as a means to demonstrate our local network operation to remote stations who are interested in seeing the system work. It's demonstration capabilities are considerably heightened if the distant terminal is able to copy KA6M/R and hear his packets being repeated.

No major modifications were made to my packet software to accomodate the patched terminal I/O, and this created some acknowledgement delays while the software waited to output characters to the slow terminal. This is currently the only difficulty, but only causes a slowing down of long continuous transmissions.

If any of you are interested in arranging a demonstration of the network for a friend, please leave me some mail here and I will make arrangements.

Mojo

FILE QST.82.04.21.0.KD2S

To: Hank
From: Den
Re: AMICON interim standard

Here are suggestions for the interim standard:

1) physical protocol

a) medium- Let's use our 15KHz unwisely for the time being, and keep an AFSK standard until better modems can be produced. We are committed to building the AMSAT 23cm linear amplifier, and should use the available 600KHz digital channel up there for low- and high- speed experiments. We are contacting other Universities who are experimenting with coding and modulation schemes, looking for the best, easiest system.

b) connection- RS-232-C is standard; also, let personal computer owners use their TNC's through whatever (parallel) scheme their TNC allows-- it matters not to the AMICON net.

2) Link Level-

a) Present and future VADCG and TAPR boards will be using HDLC; let's stick with it.

b) addressing- The present TAPR board and future VADCG boards will be using dynamic addressing, which presents no fundamental problems. The "net control" or "station node" is a very simple function which may be handled by the linking TNC. The amateur call sign is wasteful of byte-space in systems with fast turn-around times, while a single byte is all that is required for unique addressing at the local area net level. Checking into the net controller is identical to checking into the link, since they can be the same device (not required, but easy to implement). The loss of the network controller is then the loss of the link, and vice-versa, so that there is only one central point of failure, identical to the case of having no net control. The place for the amateur call sign is at the network level, so there will be no need for the transmitting station to know the binary address of the receiving station-- no bulky, global routing tables are required.

It is unfortunate that the original VADCG boards used the temporary expediency of assigning unique addresses to each board while the group was waiting for the station to station protocol to be completed. This has led to a de facto standard which will require changing all PROMS out in the field when VADCG completes their protocol. The concept of multiple ID's, common in most commercially available LAN's, has momentarily been lost to amateur radio, and with that loss goes several simple sub-net and server access schemes.

In the opinion of most of the network TNC hardware designers,

the link level is not the place for a long amateur radio call, or complicated control and routing mechanisms. This level should just handle data linking in as efficient a way as possible. We believe the dynamically alterable net control station, giving out dynamic addresses, to be the most robust mechanism for surviving network node failures, allowing easy routing through multiple, unique binary ID's existing concurrently. Although the link station always may become the NCS, reliability is only guaranteed with multiply available links, a point to remember when allowing only one AMICON link per city.

3) network level

a) network sublayer- X.25 is an acceptable standard, but experimentation at this level will not impact operation of AMICON. Both VADCG and TAPR are going to experiment at this level.

b) internet level- NBS internet protocol would probably be the most likely candidate for mutual mapping of dissimilar network sublayer protocols. For the interim standard (determining how to make our TNC's talk on the channel) however, I would suggest using naked network sublayer. The TAPR TNC will be able to talk VADCG protocol without modification, and VADCG boards appearing in a TAPR net cause the NCS to go into VADCG digipeater mode automatically. The only problem is to use the least common denominator for digipeater protocol... the VADCG system will probably have smarter digipeaters at all LAN sites at about the same time that We're ready to switch over to the full I.P. on AMICON, so I don't think we have to worry about trying to make the various nets talk the same network sublayer protocol in the future.

I suggest we incorporate I.P. as soon as the main LAN sites are ready, and certainly within one year of launch. Pauls suggestions on addressing schemes are very good, and fit within the I.P. standard. I will continue to discuss I.P. with Bob Blanc at NBS, and with the fellows at SRI who are trying to make the required software fit microprocessors.

Please note that Paul and I basically disagree only on the need for dynamic versus static addressing at the data link level, and that this does not impact the AMICON operation in any way, since the hardware systems currently out are mutually compatible, until dissimilar schemes are created. This is an important experiment, which I look forward to, as a member of AMRAD.

It might be best for AMICON to continue the policy of allowing LAN's to use whatever techniques best fit the experimenters' desires, and standardize at the levels of impact only-- the physical and network layers.

73, Den KD2S

FILE QST.82.04.25.0.KD2S

To: all members
From: Den
Re: dynamic addressing

Recent comments by Paul and Terry in their suggestions for an interim AMICON standard have shown me that I have been lax in properly describing the "dynamic addressing" system. Here are some specific comments on comments!

System Definition

dynamic address server node ("net control")... That station which is assigned the task of assigning to each node signing on, a unique, one-byte address, for the purposes of transferring data with maximum efficiency. This node shall keep a list of active nodes on the channel, and transfer or update that list as required to keep all nodes informed as to valid net members. In the event of address server failure, the node detecting such a failure will immediately assume the role of server, and perform the necessary functions to insure accuracy of server list information.

NOTE:

- 1) ALL members of the network have the ability to be "net control", and replacement of an address server node is fully automatic, as well as dynamically reassignable by consenting nodes.
- 2) There is no NET CONTROL. The only service performed by an address server is the assignment of addresses and distribution of lists of active nodes.
- 3) First one on the frequency is automatically the address server; in the case of two stations going to another simplex frequency, there is an automatic assignment of server and "servee" by this mechanism, so that no digipeater is required.
- 4) That lack of a need for a digipeater, while not unique to this protocol, does allow as robust a system as possible..if just the sending and receiving nodes survive a network trauma, the above mechanisms guarantee connectivity.
- 5) Dynamic Addressing requires no fixed addresses. This avoids the problem of more users than ID's, even though few users are on channel at any given time, and of "mobile users" entering new networks; this solution is more efficient than the alternative of having much longer addresses, decreasing the through-put of the network on every packet transfer by 4% to 40% per packet, depending on packet length (assuming a six-byte full call-sign address).
- 6) The protocol supports multiple ID's per packet. You may

specify a node by its individual address, by some common group ID, by class of service it can provide, and (by default) as a member of the global network for true broadcast capability.

Now to the response to comments:

"you must check into an NCS to connect..." - Connecting any stations together requires some form of handshaking. This protocol, for the overhead of control packets at sign-on, will prevent much traffic that would go to stations which will not happen to be on-the-air at the time of connection attempt. Remember, there is no "Network Controller", just a friendly station who wants to help new stations determine who's on channel.

"the ability to communicate after the loss of a net controller..." - see 4) above.

"satellite's footprint complicates both addressing and handoff..." - Both addressing and re-addressing (handing off) are fully automatic, and the ground links will have access to all information as to location of a node at any instant with a single query to address servers connected to links either integrally or via the local channel. No global directories are required at a central site for a satellite inter-networking facility to operate.

"at HF, the propagation..question the feasibility of net controlling at all..." - Once again, there is no Net Control. After receiving an address from some station, higher-level protocol within the node would be free to keep that address after propagation takes its toll on the paths involved. Note that this is a perversion caused by trying to use a local area network protocol in an extended network environment. It might be prudent to look at the entire problem before trying to fit existing answers.

My final comment is on the statement in the Internet Sublayer description, "...that would contribute to additional overhead which is universally frowned upon". - In designing the most efficient system without considering the level of throughput required, many simpler schemes which are not as efficient as more sophisticated (read "complex") techniques are thrown away. These alternatives should always be considered. Also an indirect impact of a piece of a protocol on total throughput of the channel is possible, by requiring more complicated mechanisms to use the "simple" service. Therefore proving a part of a protocol more efficient (e.g. "dynamic" vs "static call-sign" packet efficiency) does not guarantee the best solution. Always feel free to use multiple solutions to the same problem at different sites, with commonality guaranteed at the gateways. Why should we be different from the vendors of local area nets? (They're still experimenting too!)

73, Den KD2S

FILE QST.82.04.28.1.KD2S

to: AMICON Standards Committee
from: Den Connors KD2S

Please take a look at this draft, and give comments to Hank or me....

Amicon Interim System Specification
for the
AMSAT Phase III Satellite Channel L1

This document is meant to be used as an adjunct to the AMICON SYSTEM SPECIFICATION. The applicability of these interim standards shall be for a period to be determined by the Amicon Coordinator. Any part or all of this interim standard shall be subject to revision or elimination as the system matures. Refer to the main document for additional information on each interface level.

LEVEL 1 INTERFACE: PHYSICAL INTERFACE

1.1 Channel Assignment and Characteristics

An attempt shall be made by system nodes to keep the frequency of the unmodulated carrier as close as possible to 11.25kHz above the received frequency of the general beacon, measured locally.

1.2 (not applicable)

1.3 Carrier and Modulation Specifications

Access to the Amicon channel shall be by appropriate transmitting/receiving equipment, with a design capable of providing a signal-to-noise ratio on reception by the satellite of about 20dB or better.

Audio Frequency Shift Keying (AFSK) shall be used to modulate the transmitter. Input to the modulator shall consist of a steady 1200Hz tone to indicate a mark condition, and 2200Hz for space (Bell 202 tones). Total bandwidth of the modulated RF signal shall be restricted to 15kHz, within which will be contained all signals with levels in excess of 20dB below the carrier level. \ This modulation technique is compatible with all currently available amateur packet modems. A separate effort will be pursued, using the mode X transponder to experiment with advanced modulation techniques for introduction into the Amicon Standard. }

1.4 (not applicable)

1.5 Data Terminal Equipments

No attempt will be made by this document to standardize on the mechanism of interfacing the user data equipment to the system nodes. \It is assumed that the terminal node controllers being used will be interfaced either with an RS-232-C serial port, or some custom parallel interface.}

LEVEL 2 INTERFACE: PACKET TRANSMISSION SPECIFICATIONS

2.1 Packet Framing Specifications

No attempt will be made by this document to standardize on the mechanisms required for station nodes in attached local area networks to access the Amicon access nodes; rather, only the Amicon node (gateway) protocol will be specified, as described below.

High-level Data Link Control protocol (HDLC) will be used to control the multiple access channel.

2.2 Transmission Code

No attempt will be made by this document to specify the type of transmission code to be used within the packet. \The lack of standard specifically allows both ASCII transmission and binary file transfers; the latter will be very useful during experimental phases, for transferring program files containing the latest Amicon network updates.}

2.3 Channel Multiple Access Protocol

Access to the channel shall be by non-carrier-sensed multiple access (ALOHA) and carrier-sensed multiple access. \The latter standard allows use of sensing satellite transponder output during transmission of blocks of (identified) multiple packets, which will have transmission times greatly in excess of round-trip travel times.}

2.4 Addressing Scheme

Each Amicon node will be assigned a single-byte unique binary identifier. Addresses will be obtained from the Amicon Coordinator at some time before a gateway comes on-line. \There are several current and planned addressing schemes for local area networks. However, the very small number and immobility of the interim network nodes allows this extremely simple and efficient mode of addressing.}

LEVEL 3 INTERFACE: NETWORK SPECIFICATIONS

3.1 - 3.4 (not applicable)

No attempt shall be made by this document to standardize the mechanisms for controlling the higher network functions of the Amicon network. \There are several schemes to attempt during the

experimental period: the network level (3A) protocol may be performed with datagram or virtual circuit techniques, and the internetwork protocol (3B) has parameters which should be investigated before standardizing. For the latter protocol, the NBS Internet Protocol has been preferred by all active groups, and AMRAD has devised a good addressing scheme to fit within the standard's boundaries.}

LEVEL 4 INTERFACE: TRANSPORT LEVEL PROTOCOL

No attempt shall be made by this standard to specify any higher-level network layers of the Amicon network. The NBS is currently working on higher-level protocols for networks, and has five Transmission Control Protocol (TCP) standards, of which the #2 protocol is probably most appropriate. The Bureau is aware of our current activities, and will be sending complete documentation and coding (listings and machine-readable code written in C and PASCAL) to assist in AMSAT's Amicon experiment. Copies of Internet Protocol (IP), TCP, and session control protocols are being delivered.}

73, Den

FILE QST.82.04.29.0.KD2S

To: Hank
From: Den

I'm going to have to talk to you over the phone very soon, so advise me if there is a good or bad time.

I would like to coordinate a joint effort between the PPRS and TAPR for a presentation at the SW convention. I'll be in town a few days early (looking over Linkabit's latest offerings in packet radio and satellite codecs), and will be able to make arrangements as required. I'll be speaking to Fried Heyn tomorrow, the SCM for Orange County. I would like to set up demonstrations with you, and present introductory information on PR with booths, talks and the forum. The reports from Dayton were pretty depressing, with the forum apparently not organized well at all. We did present our alpha boards there incidentally.

We are now trying to size up the order to the PC manufacturer for the beta test boards. Pete Rowe will be calling you from your area, and would like to be in the beta test. Could you find someone from among your group who would be willing to spend some time working with owners of TAPR boards in your group? Chuck will be sending fairly complicated inspection and evaluation forms, and Lyle will want the beta site coordinator to put a 2732 PROM burning circuit that he designed into the wire-wrap area. Dave N7AIG is putting a complete, interpreting FORTH in PROM, so that the protocol in the boards may be changed on the spot, allowing a much quicker way of correcting errors and modifying protocol.

We will ship him the beta boards for his area, as well as protocol documentation, listings and PROMs. We will have on the beta board a basic TAPR protocol and VADCG protocol, and will want them tested. Some beta sites will also be involved in higher level protocols; Bob Blanc of the NBS is very interested in our beta testing, which can provide him the service of test sites for the protocols they are "pushing". He is sending us, for dissemination to the beta sites, complete documentation and listings, in both C and Pascal, as well as Pascal pseudocode logic information, the Internet Protocol, two of the five TCP's (#2 and #4), and the session control protocol. We will be in contact with the bureau via regular X.25 connections. Would you like to see any of this code, or would you be interested in beta testing some of this material? To keep the other standard covered, Gordon Beattie WB2CAM and the guys at RATS are going to develop a clean implementation of X.25 and X.75 for the board, which will allow some very good comparisons between their beta site and others.

The coordinator would have these tools for modification, but would also pay the price; we need accurate performance reporting and prompt protocol alterations throughout the user group. The large number of VADCG boards running the non-station-to-station protocol makes San Francisco by far the most ideal beta test for TAPR boards operating in the presence of a VADCG network, and I would like people who really understand the protocol to check on the code Margaret and I are writing

I look forward to seeing you in several weeks. Talk to you soon.

73, den

FILE QST.82.05.02.0.KD2S

To: All groups
From: KD2S

On May 2, the TAPR TNC board became aware of itself for the first time. Installed in PROM is a complete FORTH interpreter, capable of communicating with RAM, non-volatile RAM, and the I/O chips.

This move was not planned originally, but was decided on by having the hardware development team (Lyle) trying to bring the primitives up using only assembler. Initial efforts using the new FORTH show Lyle's productivity to increase by about ten-fold! (a very subjective test).

This FORTH will speak to our AIM65 developmental system and a couple of Apples, allowing us to burn PROMs. Our first protocol will be ready this month. VADCG and AMRAD protocols are still due to be released with beta test. Check next month's AMRAD newsletter for revised (read sensible) TAPR protocol.

73, Den

FILE QST.82.05.05.0.W6RAW

May 5, 1982

To all packet users:

This is a report of the May 4th Pacific Packet Radio Society meeting. Topics discussed included:

1. The VADCG 1200 baud modem board. Bob Reiling and Stu Neblett showed their assembled units. Bob's is completed but not tested, and Stu's is nearly complete. The bare board is available for \$12. Bob estimated the additional parts cost at around \$35.
2. The TAPR TNC project. Hank Magnuski relayed a request for people to help in the beta testing of the 6502 based TAPR board. The software is being developed in Forth. Several members of PPRS offered their help.
3. Protocol addressing. The days of a one-byte hard coded packet addressing scheme appear to be numbered. The question is what should replace it. Hank discussed several possibilities which have been detailed in previous "QST" messages.
4. Free modems. Dave Allen obtained a number of 202 compatible modem modules which were cosmetic rejects and given to him with the agreement they would not be resold. These compact, power efficient units measuring about 3 X 2 X 1 1/2 inches were all checked out and appear to function perfectly. Although everyone at the meeting got one of these, Dave regrets there are no more left.
5. The guest speaker was Roy Neal from NBC. He revealed for the first time publicly that a VDACG packet repeater was smuggled into the last space shuttle. None of us who were involved in the space/packet project will forget the excitement of working packet stations through the shuttle.
6. Packet radio illegal in U.S. Toward the end of the PPRS meeting, Larry Johnson of the F.C.C. arrived. We discussed the proposed ruling forbidding HDLC packet protocol since the F.C.C. has no way of monitoring it. The commission seems to have its mind made up on this.
7. Next meeting June 1. The group agreed to meet again Tuesday, June 1, at the Ampex cafeteria in Redwood City. Who won't want to find out if there is anything that can be done to save packet radio? (There is no

guarantee there will be any more free packet/ham radio gear though!)

FILE QST.82.05.12.0.KD2S

To: all
From: Den

I have placed copies of the June TAPR newsletter and a short article I have written on protocol on the net. See below.

73,
Den

As summer continues down here (it starts months before other people's summer), We finally are playing with our own boards! We are very busy with the software effort, and have been modifying hardware design, layout, protocols etc. as the Alpha test nears completion. See Lyle's hardware report for some of the details.

TAPR will be looking for groups of hams who are interested in helping us with testing the Beta version of our board, to prove the system in real environments, and find improvements in the protocol required to handle real-life problems. We also are setting up a second set of tests, to be performed by the same or additional Beta test sites, using software provided by some standards agencies to determine the applicability of different standard protocols in a packet radio environment. We believe this kind of experimentation is very important for amateur packet radio at this time, and performs a unique service, providing a testbed far larger than these agencies could ever hope to realize.

Our programming effort has shifted now to developing the FORTH primitives for interfacing to the on-board components, and to creating the state sequences necessary to effect the dynamic addressing protocol we have chosen for our first efforts. The higher-level routines are written, and the VADCG-compatibility program elements will also be worked on this month.

TAPR Hardware Report

Alpha boards are here! The PC released the boards on April 5th, and during the next several days the twelve Alpha testers took delivery of boards, documentation and brown paper sacks filled with parts. Soon the sacks were empty and the boards full. Those of you who were at Dayton got a sneak preview of an Alpha board, courtesy of Pete Eaton, WB9FLW. And we certainly appreciate the constructive comments made at Dayton regarding the TAPR TNC --wait 'till you see the Beta boards!

Due to some job commitments, forced travel, examinations and other events that somehow get in the way of more important things such as Amateur Radio, the Alpha test phase is a bit behind

schedule, to no one's complete surprise. Nonetheless, considerable progress has been made. By May 8, the following Alpha-level hardware goals had been achieved:

- * interface of the TNC to a variety of terminals/computers
- * self-test at power-on with status report
- * activation of the HDLC controller
- * activation of the CW ID facility
- * verification of parallel port operation
- * verification of NOVRAM interface
- * verification of the watchdog timer function
- * verification of the modem design and interface
- * on-board calibration of modem frequencies to +/- 5 Hz.

In addition, a major software achievement was realized on May 1, when N7AIG, aided and harrassed by WA7GXD and Mark Baker (TAPR secretary, no call yet), got an advanced version of STC FORTH running on the TNC in a standalone configuration. This was a major test of N7AIG's MetaFORTH target compiler (running on his Apple), and Dave's efforts have made the Hardware Committee's debugging and low-level driver coding tasks much easier.

It is now anticipated that TNC's will be talking to each other in the very near future. Hardware efforts will then turn to Beta activities, including a meeting with the Computer-Aided Design (CAD) boys for possible computer-generation of the Beta artwork. Component suppliers are beating our doors down in an attempt to make the Beta (and beyond) boards lower in cost, and We're listening! Our goal is to make the TNC, as well as future developments, available to the entire Amateur Community on a non-profit basis. (Yes, we are capitalists, but we just don't beleive in making money off of our Amateur bretheren.)

Now for a look at the microprocessor side of the TNC design.

The TNC has a specific mission -- implement the lowest layers of packet protocol. Since the definition of these layers is in a state of flux, the TNC must be very adaptable. This implies programmability, and in today's world, this means a microcomputer. Thus, the TNC is a small, dedicated-function computer.

Naturally, virtually every silicon foundry has a pet microprocessor (uP) and they are not necessarily compatible with each other. Every family in the microprocessor world has its unique, special function peripheral parts, and some of these are very useful in the specific case of a TNC design. The rub comes when a project requires the use of a certain uP, and the uP

chosen by (or forced upon!) the designer lacks the right peripherals. Then there are manufacturers who just make sophisticated peripherals that won't directly interface with anyone's uP -- such parts are called "universal".

It happens that, within TAPR, the majority of the group have a soft spot for the Motorola architecture, and some clever people at Commodore made up a uP that is bus-compatible (that means that the hardware interfaces the same) with the Motorola family (6800,6802,6809) and the uP they made, called a 6502, is very popular. Every Apple, PET, Atari, AIM, KIM and SYM has one. So does the TAPR TNC.

The 6502 family incorporates some powerful peripheral chips, such as the 6551 UART (with baud-rate generator) and the 6522 Parallel Interface (with dual 16-bit timer/counters), both of which are on the TAPR TNC. The family does not include a good HDLC controller (good means on-board PLL for clock recovery from NRZI data as used by nearly every packet group).

Meanwhile, on the other side of the uP architecture, Intel and others have their own families, and were responsible for pushing through a memory standard endorsed by JEDEC (which doesn't necessarily mean much), and many manufacturers have jumped on this bandwagon. The concept is called "byte-wide", and it makes for a universal socket that can take ROM, EPROM, EEPROM and RAM. It uses a "two-line" control, which is nice for them and bad for the Motorola types. (Heh,heh -- very clever.)

Another outfit, called Western Digital, makes smart peripherals for doing things like HDLC control. Rather than take sides, they use an Intel-like control structure, but invert all the lines so the HDLC chip will need TTL "glue" with everybody's uP. Then they undercut the market with pricing so designers can buy some TTL and still save money!

With this background, the TAPR Hardware group appeased the majority by using the 6502 (in all fairness, a good chip, and one that has a lot of software development behind it within the TAPR infrastructure), the byte-wide memory standard and the Western Digital HDLC controller. (For those who may be concerned about the compatibility of the WD 1933 chip with the 8273 used on the Vancouver TNC, let me point out that the KA6M repeater in San Francisco uses the 1933 chip.) As it turns out, the TTL glue needed to tie all of this together, including the clock generator, comes out to four packages, plus a Shottky PROM used for address decoding to allow any mix of RAM/ROM sizes in the byte-wide memory area. Alpha TNC's are set for 2 2k-by-8 RAM's and 4 4k-by-8 EPROMS, but the sockets can handle up to 8k-by-8 parts, and the address decoder can be changed very,very easily.

The net result is a TNC that is easily reprogrammable (in a high-level language called FORTH - but that is another issue), capable of using the latest technology in memory components for

future expansion and very economically priced due to the use of multiply-sourced parts.

Next month we'll try to highlight some of the hardware-oriented goals of Beta test, as well as report on Alpha progress.

Meanwhile, if you happen to be in Southern California during the weekend of June 4-6, be sure and come to the ARRL Southwestern Division Convention and San Diego Computer Fair -- TAPR will be there in force, with operating TNC's. Saturday morning will include a full session on packet radio, with participants from all over. We're looking forward to a great time, and hope to convert many an ASCII/RTTY buff to packet. Hope to see YOU there!

73's from the TAPR Hardware gang Lyle Johnson, WA7GXD
TAPR Protocol Report

Last month's AMRAD newsletter included comments and comparisons of Terry Fox's protocol proposal and the TAPR protocol. The TAPR effort has been modified heavily since the last (December) release, and now complies very nicely with "standard" protocol and interface definitions. Take a look at my article in this newsletter on protocol for more information on what TAPR will be doing.

And So On

Mike Parker and the Microwave Committee have performed initial tests on the type of transverters that AMSAT plans to use to access the L- band transponder input on phase IIIB, using an AMSAT-supplied box sent down here a couple of weeks ago. Preliminary design should be completed before the next newsletter. Volunteers for Beta testing are still being sought.. we currently have fifteen major cities lined up, with more due, but the first Beta distribution will be pretty much settled before next month.

Stay tuned for more reports on local and national activities of the TAPR group!

73, Den KD2S

PROTOCOL EXPOSED !
(or "Why I Don't Talk to Myself")

By Den Connors KD2S
Tucson Amateur Packet Radio

I don't normally talk to myself, but if I do I never listen anyway. At least normally. But after several weeks of very heavy labor both at work and for TAPR, I found myself discussing things in my brain. "Self," I said, "I'm really proud of how well the different groups involved in packet radio have done to date. Did you notice that We're all using standard protocols?"

"Excuse me, but I'd like to see how I came to decision!" "What do you, I mean me, mean by that? The VADCG group has chosen HDLC, and AMRAD is working on an ADCCP package. Even TAPR is looking at a subset of the IEEE-802 LLC (logical link control)." "Look again... How often do you guys read those standards? The first two bit-oriented protocols were never designed for local area network use. They were meant for a primary point to link to one or more secondary points, on a dedicated line. Which groups send a continuous stream of frame flags or "breaks" down the line when the primary's not transmitting?" "Well that's just a stupid thing to do on a radio channel. Of course none of us block the channel!" "Yet you'll find that in the HDLC standard. Never mind. Answer this then: All of the protocols involved presume the address of the primary, and so ALL addresses are that of the secondary, receiving station. I don't recall that the above-mentioned groups are placing the receiving station ID in their packet address space at all." "Well, that's true. The ID used is always that of the sending station instead." "That's right. So none of you hams are using some fundamental aspects of these protocols. It's a good thing too." "Why do you say that?" "You guys are misusing these protocols to let you get onto the radio channel with packets. You change the standard around to reflect the fact that there's a repeater on channel who will be instrumental in routing the packets, based on initialization schemes using the control field. The medium is not one of a primary in control of slaved secondary stations. It's one of multiple primaries, or nodes, all with the power to initiate conversations at will." "OK, so we don't run HDLC, or ADCCP or what-ever. But notice that I said TAPR is using a sub-set of LLC, a brand new protocol DESIGNED for local area networking! I think we have the jump on all the other groups!" "Think again Charlie. What you guys will be using is a dynamically-assigned, single byte addressing scheme with both the sender and receiver ID in the packet header. That allows a balanced mode of operation, but ADCCP and a few other protocols allow balanced modes without double addressing anyway. Your problem is that the IEEE standard also calls for a "medium access layer" sitting smack dab between the physical and link layers, and that layer is more complicated than anything any of the ham groups have come up with yet! I think you'll find that using a protocol designed for a 10Mb/s link would be just as bad as using one for point-to-point. All groups are justified in using whatever "sub-set" of whatever protocol they want, since there is no standard designed for slow packet radio channels!" "Sigh.. I guess we're not at the point yet of defining a universal standard for balanced-mode transmissions on a shared medium that doesn't lend itself to simultaneous collision detection, true?" "I'm glad you said that... Sounds like you hams have a lot of work ahead of you in figuring out what will work best. Keep up with protocols BASED-ON, but not compatible with, the standards already out, and the controller chips will help you out financially. The IEEE will have some standards for broadband coaxial cable networks in the near future, and the head-end translator looks a lot like a repeater.... Keep up the experientation..." "OK. Now can I

go to sleep?"

TAPR PROTOCOL

The Tucson Amateur Packet Radio group will be using a protocol based on standard segmentation of networking tasks into levels of protocols with well-defined interfaces between levels.

PHYSICAL LEVEL

The physical medium includes medium access procedures, specifically using carrier-sensed multiple access on a channel which may have, but does not require, a simplex digital repeater. The two tones used by the Bell 202 standards will be used for mark and space, and NRZI encoding will provide for synchronization of the incoming packet to the demodulator.

LINK LEVEL

The data link layer operates on the physical channel, controlling access and utilization. Specifically, the link layer handles:

- control of data transfer
- error checking and recovery
- information coding
- information transparency
- optimization of channel utilization
- maintenance of synchronization
- communication facility transparency
- remote node bootstrapping capability

A "sub-set" of the IEEE-802 Local Area Network Standard is used, a combination of the Logical Link Control and Medium Access Control. Medium Access (MAC) fits within the LLC packet, and may be used to handle a large number of medium specific problems which simply cannot be handled by the point-to-point and multi-drop bit-oriented protocols currently in use. Multiple control stations, nodes located in multiple local area network domains and other problems of this ilk can be controlled by expanding header bytes beyond the control byte.

The control patterns used in the control byte are defined by LLC, and are identical to those of HDLC, SDLC, ADCCP and others. There are two address bytes, those of the sender and receiver, allowing non-repeater and repeater operation. The addresses are given to nodes at the time the node enters the net by the first station on the channel. This station, designated the Net Control or Station Node, is identical to all other nodes on frequency, except that it parcels out addresses for nodes checking in, and distributes to all nodes current addressing information. By default then, any stations leaving a net immediately lose their ID, and are given a new ID upon arriving at any new network. If no net exists on frequency, that node becomes the net control. No multiple address problems are possible in this type of addressing scheme; if a system failure occurs, however, the net control simply reassigns ID's to

violating nodes. Note also that all information for giving out ID's is available at all nodes, so that the loss of the net control is handled trivially by the first station detecting loss picking up the NCS .

NETWORK LEVEL

The current network layer must handle the functions normally associated with control of the local area channel, transport of messages and interfacing applications programs for these early networking experiments. Specific functions handled by this layer are:

- support of datagrams and virtual circuits
- opening and closing connections
- data transfer
- error control
- message flow
- routing of messages to destinations

The mechanism for flow control is the simple stop-and-go type of algorithm, identical to other packet implementations. Certain of the functions called out are also found in the link-level protocol, since these hooks are required to pass the functions through the channel. There will be more on this protocol written in the TAPR activities column by the Software Group, as "things develop".

FILE QST.82.05.18.0.W4RI

TO : All
SUBJ: Am7910 Single-Chip Modem

You will be interested in reading the May 12 issue of EDN Magazine. More specifically, I refer to the article, starting on page 143, entitled "Single-chip FSK modem expands your design choices," by Michael K. Stauffer of Advanced Micro Devices Inc.

In one 28-pin chip, the Am7910 is able to become a Bell 103 originate, Bell 103 answer, Bell 202, V.21 originate, V.22 answer, or several flavors of V.23 by setting mode-control input lines.

I called Mike Stauffer for some more info. He said that samples would be available mid-June with production in August-September. The onesy price will be in the \$35-40 range initially with quantity prices dropping to the \$10-15 ballpark as they move down the "learning curve." The guy at AMD to talk to about samples, prices, and other marketing info is Ray Lett, 408-732-2400 ext. 3774.

This chip looks good not only for Bell 202 packeting but phone-line applications. I intend to follow up on this and possibly build up something using this chip. I would appreciate any developments on this chip for the AMRAD Newsletter.

73, Paul, W4RI

FILE QST.82.05.18.0.WB2GDQ

Date: May 18th, 1982
To: Hank, KA6M
From: Steve Gross, WB2GDQ
Re: VADCG TNC Memory
CC: Paul Rinaldo for AMRAD Bulletin

Here is the summary of memory modifications which you requested me to document:

I have wired up my board for 5 volt only EPROMS, but I am having trouble finding 16K Rams in a 4K by 4 arrangement (which can be placed where the 2114's are currently). This can be done by replacing the 18 pin sockets with 20 pin sockets as all the wiring stays the same except for the two new pins and the old VCC pin which becomes an address line. The only versions which I have found so far are the 70ns (and faster) Inmos chips, although the 2K by 8 variety seem to be quite cheap and in large supply. Unfortunately, there are only 4 - 24pin sockets on the board, so modifying it to handle that configuration by adding additional sockets would be significantly more difficult.

So, for the moment, I think I'll leave the address decoding as is and use 2716's as though they were 1K by 8 roms. At least that way I can use the 5V only chips and eliminate the -5V supply from the board. The modification to do so is very simple. The +12 volt and -5volt lines on the 2716's are disconnected from their respective power supplies (just where they connect to the supply rail) and are replaced as follows:

pin	old	2758	2716	2732
19	+12v	gnd	A10	A10
21	-5v	Vcc	Vcc	A11

For the 2716 and 2732 mods, either an additional 74LS138 must be added or ideally, 2732's and 4Kx4 static rams can use the same 74LS138 and just change the following inputs:

pin	name	old	new
1	A0	8085-22	8085-25
2	A1	8085-23	8085-26
3	A2	8085-24	8085-27

Note that the 8085 pins are mislabeled on the VADCG TNC schematic and the pins should be as follows:

8085-21	A8
8085-22	A9
8085-23	A10
8085-24	A11
8085-25	A12
8085-26	A13
8085-27	A14
8085-28	A15

That concludes the mod's necessary to quadruple both the ram and rom address space. Note that if you are willing to partition your ram into disconguous 1K blocks (or 2 discontinuous 2K blocks) you can make the 2732 mods and continue to use the 2114 rams but quadruple your prom address space. With the current low prices on 2732's. You could also double both your prom and ram address space by using a pair of 2732's (8K total), the original 2114's (4K total) and 2 6116's (4K total RAM). This change would require that the ROM write-inhibit logic be disabled (U7-pin 4 grounded instead of tied to U7 pin 3, for example).

Steve

FILE QST.82.05.19.0.W2FPY

Hank -

With the '2' callsign, I WAS hoping Steve was in our area... Oh, well.. His suggestions on the VADCG board sound appropriate. My preference would be to doctor the negatives and reshoot the board with decoding for the 2K x 8 EPROMs and RAMs, eliminate the 2114 sockets, and put \decoded\ 24 pin sockets (eight of them) across the top of the TNC board.

As an aside, Hank, I have been thinking more and more about the implications of the TAPR protocol (although I still can't see it in its entirety). By definition, the GLOBAL network will be a WEB type topology. Even regional nets will have a WEB RATHER THAN A STAR-TYPE STRUCTURE. In principle, why not extend that to the local net? Maybe its the aesthetics of it - you know, the symmetry, but I think TAPR is heading in the right direction for an amateur network...

About AMICON, I think we have a reasonable interim document. When do you want to 'publish' the protocol/hardware interim standards?

Forgot to mention the 220 radios.... I spoke with Ed Clegg the other day, and he has been doing a little foot-dragging. I know he'll go through with it soon, but he is in the process of merging with another company, and hasn't had the time to do the inventory. It is based on this inventory that he will calculate the going price for the FM-21s. Mine has been in service and interfaced with the TNC board for quite some time. It has been eminetly reliable. Expect the going price for the FM21s to be in the range of \$30 to \$60, depending on that inventory. Also, let it be known that I do NOT intend to profit from this venture. Aside from postage/shipping charges, any packeteer desiring an FM21 will get it at my cost - until the supply runs out.

- Steve, W2FPY

FILE QST.82.05.19.0.WB4JFI

To : Hank

From: Paul
Subj: VADCG TNC Memory Expansion

Thanks for the info from Steve Gross, WB2GDQ. As coincidence has it, Terry Fox, WB4JFI wasn't able to go to Dayton because of work commitments. Instead, he stayed home and worked up a mod to the VADCG TNC board. Here is an article, written by Terry, for the June AMRAD Newsletter which is ready to go to press now. (You'll have to wait until you get the newsletter for the Figs.)

VADCG TNC Modifications Terry Fox, WB4JFI

I have found that we are rapidly approaching the limits of memory on the Vancouver Amateur Digital Communications Group (VADCG) Terminal Node Controller (TNC) board. It is just barely able to handle the link level software in the four 2708 EPROMs used on the board. This means that any network-level software must be done external to the TNC board. One approach is to come up with a new TNC board that has more memory on it, both RAM and EPROM. The other option is to expand the capabilities of the VADCG TNC board. I should point out at the outset that this modification is a kludge, but at least it works! Only one IC is added to the board, and it is put on the board dead-bug fashion (upside-down).

This modification is done in two parts, first the RAM on the board is moved from its present location (1000-1FFF hex) to a new location to allow more EPROM memory. The new location is 8000-8FFF hex, which should allow up to 32k of EPROM memory. This location also simplifies the hardware modifications required. The second half of the modification changes the EPROM sockets to allow the use of either 2716s or 2732s.

Relocating RAM to 8000 Hex

This part of the modification requires the addition of another IC, called U27, which can be either a 74LS138, or an 8205. U27 becomes the RAM address decoder, while leaving U8 the EPROM address decoder. I should point out that the schematic that I received with my VADCG TNC board has some minor errors. One of these is that address lines A8 thru A15 from the 8085 (IC-1) are back wards. A15 is pin 28 of the 8085, A14 is pin 27, etc... down to A8 being pin 21. Using the proper pins is important to this modification, so be careful of this error.

When this portion of the mod is completed, the TNC should still operate using 2708s for the EPROMs. I recommend that the board be completely assembled and tested before doing any modifications. Have someone burn a couple 2708s with repeater software for your call in them, one version for RAM at 1000 hex, and the other version for RAM at 8000 hex. Even if you don't use your board as a digital repeater, it is a good

test of the TNC, and usually will fit in one 2708. Test your completed TNC to make sure it functions properly. Refer to Fig. 1, 2 and 4 while doing this mod. I have laid the mod out in steps to make it easier to follow and check off. Cuts on the board are shown as a small X thru a trace.

1. Cut traces between U8 pins 7,9,10,11 and U19 to U26 pin 8. The cuts are done by U8 with pins 7, 9, and 10 cut on the top (Fig. 1), while the pin 11 trace is cut on the bottom of the board (Fig. 2).
2. Cut the trace at U8, pin 5 to ground (Fig. 2). Hook U8, pin 5 to U1 (8085) pin 28 (A15).
3. Drill two holes as shown in Fig. 1. These holes facilitate the wiring of U27. Be careful not to drill thru any traces.
4. Add IC-27 (74LS138, or 8205) to the board as shown on Figure 1. It can be glued to the board if necessary, or use double-sided tape. Put a 16 pin solder-tail socket to it to allow replacement in case it should fail, and wire the pins as follows:
 - A. U27 pin 1 (A0) to U1 pin 23 (A10).
 - B. U27 pin 2 (A1) to U1 pin 24 (A11).
 - C. U27 pin 3 (A2) to U1 pin 25 (A12).
 - D. U27 pin 4 (E1) to U1 pin 34 (IO/M*).
 - E. U27 pin 5 (E2) to U7 pin 11 (RD/WR)
 - F. U27 pin 6 (E3) to U1 pin 28 (A15).
 - G. U27 pin 8 (GND) to ground bus as shown.
 - H. U27 pin 12 (O3) to U25+26 pin 8 (CS*) at cut
 - I. U27 pin 13 (O2) to U23+24 pin 8 (CS*) at cut
 - J. U27 pin 14 (O1) to U21+22 pin 8 (CS*) at cut
 - K. U27 pin 15 (O0) to U19+20 pin 8 (CS*) at cut
 - L. U27 pin 16 (+5V) to +5 volt bus as shown.

Now that U8 is only used for EPROM's while U27 is used for RAM, U8 doesn't need to be enabled selectively with WR, but just with RD from U1. U27 needs to be enabled with either RD or WR from U1. These changes are done by rewiring U7, the 74LS00 as follows:

- A. Cut the trace between pins 3 and 4 of U7 on the bottom of the board (Fig. 2.) This trace is thick; so check with a meter to be sure it is totally cut.
- B. Cut the trace between pins 6 and 10 of U7, located on the bottom of the board (Fig. 2).
- C. Cut the trace between pins 14 and 13 of U7, also on the bottom of the board. This is

also a thick trace; so check the cut.

- D. On the top side, cut the trace from U7 pin 5 to the small feedthru as shown in Fig. 1.
- E. Wire U7 pin 2 to U7 pin 4.
- F. Wire U7 pin 5 to U7 pin 9.
- G. Wire U7 pin 6 to U7 pins 13 and 12.
- H. Wire U7 pin 10 to U7 pin 14 (+5V).
- I. U7 pin 11 should be hooked to U27 pin 5 from step E of adding U27 above.

Double check your wiring. It should now match the schematic in Fig. 4. If it does, install the EPROM that has software for RAM at 8000 hex, and try out your board. If everything is working, the TNC should operate as if unmodified. If not, recheck your wiring for mistakes.

Your board now has the RAM relocated to 8000 hex which will provide a lot of address space for the new EPROM added in the next step.

Changing the EPROM to 2716 or 2732

Since there are only four EPROM sockets, the TNC is severely limited in how much software can be run. I feel that if a separate processor is used to generate and receive packets, it should be able to run most all of the networking overhead, not just the link level. The four 2708 EPROMs are just about full with only a bare-bones version of the link-level software, so there is no room left for the actual network software or anything above that level. This mod will allow the use of 2716 or 2732 EPROMs instead of the 2708s being used. This will change the maximum EPROM capability from the present 4k to 8k (4-2716) or 16k (4-2732). An added feature of this mod is that the minus 5-volt power supply is no longer used, and can be eliminated.

Part 1 of this mod pertains to both 2716 and 2732 EPROMs, while part 2 should only be done for the type of EPROMs to be used.

Part 1, 2716 and 2732 Mods

Do this part of the modification for both 2716s and 2732s. Again, the mod is done so that your progress can be checked off.

- 1. Cut and isolate pin 18 of U15, U16, U17, and U18 from each other and from grounds at both U15 (top of board) and U18 (bottom of board).

2. Cut traces between U15 thru U18 pins 20 and U8 pins 15 to 12. Wire as follows:
 - A. U15 pin 18 to U8 pin 15.
 - B. U16 pin 18 to U8 pin 14.
 - C. U17 pin 18 to U8 pin 13.
 - D. U18 pin 18 to U8 pin 12.
3. Cut the trace hooking U15 thru U18 pin 19 to ground at some point between U18 and the ground bus. Hook the U15 to U18 pin 19 trace to U1 pin 23 (A10).
4. Wire U15 thru U18 pin 20 together and tie them to ground.
5. Cut the trace hooking U15 thru U18 pin 21 from the -5 volt bus between U18 and the -5 volt bus as shown.
6. Cut the traces at U8 pins 1,2, and 3.

Part 2, 2716 Wiring

- 5A. Hook the trace of U15 thru U18 pin 21 to a +5 volt bus (U18 pin 24 is OK).
- 6A. Wire U8 pin 1 to U1 pin 24 (A11). This can be done by hooking U8 pin 1 to the trace just cut from U8 pin 2, which is A11.
- 6B. Wire U8 pin 2 to U1 pin 25 (A12). This can be done by hooking U8 pin 2 to the trace just cut from U8 pin 3, which is A12.
- 6C. Wire U8 pin 3 to U1 pin 26 (A13). This could also be wired to ground, but wiring it to A13 will allow more EPROMs to be added later on.

This completes the modification. Plug in a 2716 with some software in it and try it out.

Part 2, 2732 Wiring

- 5A. Wire the trace connecting U15 thru U18 together to U1 pin 24 (A11).
- 6A. Wire U8 pin 1 to U1 pin 25 (A12). A12 can be picked up from the trace just cut from U8 pin 3.

6B. Wire U8 pin 2 to U1 pin 26 (A13).

6C. Wire U8 pin 3 to U1 pin 27 (A14). Pin 3 could alternatively be hooked to ground if no additional EPROMs are going to be used.

This completes the 2732 modification. Plug in a 2732 with some good software in it and give it a try.

Additional Memory

These modifications leave room for further additions to both the EPROM and RAM space. To add more EPROMs might require some swift work, as additional EPROMs cannot be piggy-backed. One approach might be to kludge sockets onto the back of the board, and wire them to the present sockets, except for the chip-select pins. They are hooked to the remaining enable outputs from U8 (pins 11, 10, 9, 7) as required.

The RAM is easier to expand. Just piggy-back the additional 2114 chips on top of the present ones (U19 to U26) except for the chip selects (pin 8), which go to U27 pins 11, 10, 9, and 7. This will double the RAM on the board from 4k to 8k.

Make sure you remind whoever burns your EPROMs which ones you are using and that your RAM is now at 8000-8FFF hex. Happy packeting!!!

FILE QST.82.05.20.0.W2FPY

Den,

I just spoke with Tom Clark, W3IWI, concerning the interim modulation standard. I'm afraid I've committed a faux pas by even suggesting AFSK FM techniques for Phase III-B. Unless you've got an EME quality station, it's unlikely that you'll squeek even one packet through without a bit error. We need to do the following:

1. Do the link calculations for the previously proposed and now inoperative standard (I'll do this on my end, too, and we'll compare notes).
2. Come up with a liveable modulation scheme, even if it means building an AFC loop to track the doppler shift.
3. Do link calculations for the new standard.
4. Build some prototype hardware. This is a tough one... I think we can justify the work by pushing the baud rate up in the terrestrial packet activity. I'd like to have a direct hand in this one.

Other subjects of conversation included holding a Workshop

and/or a Symposium on satellite techniques (including digital communications) prior to the AMSAT annual meeting. Tom needs input into this one, as well as participation from the rest of the country (read between the lines, 'we need your participation').

Lastly, Tom is one of us - a packeteer. He is going to be instrumental in the planning, and allocation of AMSAT resources to satellite packet radio activity. Let's try to get him on prnet. How about it?

73, Steve w2fpy

FILE QST.82.05.29.0.W4RI

TO : Steve, W2FPY

Re your msgs of May 19.

1. Concerning the existing 1200-baud Bell 202 'standard,' I think that I agree with your basic point that we should not keep it any longer than we have to. One problem, of course, is that the FCC Rules presently limit us to that speed on 10 meters thru 1 3/4 meters, so we can't toss it overboard until that restriction is lifted. Also, the problem breaks out into backbone vs. local area nets. For the backbone net, I think that we should graduate to something faster as soon as possible. Local area nets will probably be slower to convert until they get some hosts running local services which use some appreciable part of the channel capacity. On paper, the FCC situation is as follows:

a. In PR Docket No. 81-699, RM-3788, the FCC proposed that "Sending speeds as great as 19.6 kbps may be utilized on those frequencies between 50 and 225 MHz provided that the bandwidth of such emissions does not exceed 16 kHz."

b. AMRAD's comments which were filed January 12, 1982 recommended that between 220.5 and 221.9 MHz the speed limit be raised to 56 kb/s. The ARRL agreed with us and supported our comments in their reply comments of February 16, 1982.

c. Also involved is that the FCC proposed changing the Rules to specify "bits per second" rather than "baud." Bob Carpenter, W3OTC and AMRAD recommended that the FCC stick with "bauds." However they come down on this may affect our choice of modulation.

2. Yes, we are interested in the MSK encoder/decoder, as well as anything that you might have comparing MSK and PSK.

3. The rumor that someone in AMRAD has the VADCG TNC boards is probably just rumor. We've asked the most likely people and haven't located it. The main problem that we see with the VADCG board is the limited memory. Terry Fox's article in the June AMRAD Newsletter is one way of temporarily getting more memory for the purpose of developing network-level software. We'll be

looking at the TAPR board too.

73, Paul, W4RI

FILE QST.82.06.04.0.KD2S

To: All groups

From: Tucson Amateur Packet Radio

On June 2nd, 1982, incorporation papers were filed to create the Tucson Amateur Packet Radio Corporation, licensed in the state of Arizona as a non-profit scientific corporation. The stated purposes of the corporation are:

" scientific testing and research into the development and improvement of communication systems for use in the Amateur Radio Service, including but not limited to digital packet radio communications; the research and testing of systems, hardware and software for packet radio local area networks and computer network systems; and disseminating to the public information obtained as a product of such research and testing..."

The TAPR Corporation was formed to serve as a liason between standards organizations, profit and non-profit corporations and the amateur radio groups interested in this new technology.

Den Connors, President TAPR

To: all groups

From: Tucson Amateur Packet Radio

The TAPR Microwave Committee, headed by Dr. Mike Parker, KC7GD, has settled on a design strategy for the AMSAT phase III L-band linear amplifier development effort in Tucson. An Arizona-based corporation is donating to TAPR the required transistors to create an all solid-state amplifier in the 20-40 W class, using L-band pulsed-power transistors.

Following receipt of the devices and ancillary components, an initial set of prototypes will be built and tested with equipment recently acquired for TAPR by Mike. The schematic, board layout and design/implementation notes will be released when available.

Den Connors, president TAPR

To: All groups

From: Tucson Amateur Packet Radio

Initial negotiations were completed on May 28th between TAPR and the NBS, setting up a cooperative test program of NBS higher-level protocols using the soon-to-be-emplaced TAPR Beta test sites.

The NBS is sending TAPR complete listings, documentation and

programs on magnetic tape, for implementing the current (prototype) offerings of internet and higher-level software algorithms. Updates will be sent automatically as required.

TAPR will be looking for voluntary support from Beta test sites during the later phase of testing, if the different protocols prove useful for amateur packet radio. We will be using a conventional X.25 packet network for communicating with the standards labs at the Institute for Computer Sciences and Technology.

Den Connors, President TAPR

To: all groups
From: TAPR

Any groups requiring beta boards from TAPR for the beta testing stages this summer should advise us not later than next Friday, as we have decided to keep the actual tests limited to 75 participants, or approximately 5 testers per site. Just leave a message on the PRNET telling me calls and names.

Our official release date for beta is six to twelve weeks, with seven weeks the most likely time for boards that will speak VADCG and TAPR protocols (concurrently). Transformers, connectors and cables have been added to the release, allowing us to sent out completely assembled and tested units to beta test sites (that's the only way these 75 boards will go out this time). The price will still be under \$200 for the whole system (they're being released to testers at cost)..

73, Den

FILE QST.82.06.10.0.KD2S

To: All groups
From: TAPR

Our July newsletter follows below. Feel free to distribute the information to all.

73, Den

Hello from a very excited bunch of hams in Southern Arizona! We have expanded our numbers very rapidly in the last month, are dangerously close to finishing our alpha hardware testing and the initial interface and protocol software, and have heard first test packets from our boards. We were involved in the ARRL SW Convention during the first weekend in June, with great success, and we have been "pushing packets" through a new public relations staff. We have also formed a non-profit scientific corporation to handle relations with a number of corporations, university groups and government agencies, in an effort to expand the size and breadth of the amateur packet radio effort.

On June 2, 1982, the Tucson Amateur Packet Radio Corporation was licensed in the state of Arizona as a non-profit scientific corporation. The stated purposes of the corporation are: "...scientific testing and research into the development and improvement of communication systems for use in the Amateur Radio Service, including but not limited to digital packet radio communications; the research and testing of systems, hardware and software for packet radio local area networks and computer network systems; and disseminating to the public information obtained as a product of such research and testing...". The TAPR Corporation was formed to serve as a liaison between standards organizations, profit and nonprofit corporations and the amateur radio groups interested in this new technology.

TAPR and AMRAD will be forming formal affiliation later this month, and will be working together closely on very common grounds.

TAPR Hardware Report de Lyle Johnson, WA7GXD

The Southwestern Division ARRL Convention in San Diego was a smashing success from the Packet Radio standpoint. Alpha TNCs were connected via hardwire link, and two terminals were connected up so folks could send packets back and forth. ARRL President Vic Clark, W4KFC, visited the TAPR booth and was given a brief demonstration of this exciting new mode. The Saturday A.M. forum was so successful that TAPR ran an unscheduled "Introduction to Packet Radio" presentation that afternoon. The hall was packed, with the overflow lining the walls. Eventually, the doors were opened and people were crowding in the hallway, straining to catch every word. Many an ASCII/RTTY buff appeared ready to convert, with plenty of active audience participation. An unqualified success.

Alpha boards are currently running some diagnostic software that reports on CRC status, etc., for hardware/modem debugging. This software allows direct interface to the TAPR/FORTH kernel for hardware interaction. The net effect is to greatly accelerate hardware debugging and patching.

Alpha boards appear to be about 95% functional as of this writing (10 June 1982). The weekly TAPR net of 9 June 82 witnessed the first TAPR packet transmission when WA7GXD surprised everyone with a couple of test messages. The real "acid test" of exchanged packets via radio link is anticipated for the weekend of 12-13 June 1982, barring any unforeseen interference from jobs and other such meddling.

The Beta Test of the TAPR TNC is planned to start sometime in July. While Alpha Test is primarily hardware-related, with software/protocol feasibility testing thrown in. Beta Test is primarily software/protocol oriented, with interfacing the primary hardware goal.

The Hardware group will be supporting the Beta Software testing by providing an EPROM-programming adapter for the TAPR TNC. This adapter connects to the parallel user port, and will enable the Beta Test site to program the 2732 EPROMs used in the TNC. It is expected that each Beta Test Coordinator will obtain one of these adapters for his particular Site and do the programming for his group. This will enhance the flow of software up-date information and free the Tucson group from excessive correspondence in this regard.

The Beta-specific Hardware goals are to interface the TAPR TNC to as many radios and computers/ terminals as possible. Each Beta Site will provide a list of radios that are accessible to that Site for Beta test, and it is hoped that all radios in the Site will be interfaced. To avoid duplication of efforts, and to enhance productivity within the Sites, TAPR will coordinate the cases of multiple sites with the same radios. Some sites will design the interface; others will evaluate it. The results of all these tests, along with detailed schematics and any needed hardware patches in the wire-wrap area, will be compiled by TAPR for inclusion in the TNC Installation Manual.

Similarly, the Hardware aspects of computer/ terminal interfacing will be developed, tested, proven, and documented at the various sites. A description of any adapter that must be fabricated, such as a parallel port for the TRS-80-I or the ZX-80/81, will be compiled for inclusion in the same TNC Installation Manual. Additionally, software guidelines and flowcharts will be sent to each Beta Site for development of drivers to allow all personal computers in the Beta Test to communicate on the TAPR TNC. The software will be documented, tested by other Sites, then compiled and included in the TNC Installation Manual. Naturally, the Tucson group stands ready to assist the various Sites in the attainment of these goals.

Other hardware goals of Beta Test include reliability information and documentation. Documentation is considered to be a primary goal by the Hardware group. How often have you purchased a piece of Amateur equipment, and paid a professional price for it, only to find the manual aimed at a CBer? The other cases included no documentation or "service manual" extra (like \$25 or so).

The TAPR TNC will include a complete, blow-by-blow description of the circuitry, both at the block diagram and detailed schematic levels. The Installation Manual will include complete information for radio and computer/terminal interface, with any needed software drivers listed and hardware adapter schematics provided. A User's Guide will detail the operation of the TNC and explain the theory of the TAPR protocol.

The overall goal of all of this testing, documentation, etc., is to make the Packet Mode available to the non-technical Amateur community as well as to the technical, experimentally oriented types. TAPR strongly believes that the advantages of Packet

communication make it imperative that this mode be generally available. Beta is a necessary step in this process. Only after the system has been thoroughly field-tested will it be released to the Amateur community at large.

As may be seen, Beta Test is not merely promotional hype, nor is it a disguised marketing effort. It is, in fact, a comprehensive testing procedure designed to maximize the utility and help promote the acceptance of Packet Radio by the Amateur Community. If San Diego is any clue, Packet will be to the 1980's what FM was to the 70's and SSB was to the 60's.

If you would like more information on Beta Test, or desire to participate, please contact TAPR at the address given at the end of this column. Beta Test will be limited to 75 boards. boards.

Next month, we'll list some of the more commonly heard questions about Packet Radio, as well as the answers. A report on Alpha progress will also be included. ... 73 from the TAPR Hardware gang

On other fronts, Mike Parker, now KT7D, and the Microwave committee have chosen the parts for the solid-state L-band linear amplifier for the AMSAT phase IIIB transponder. We have a new public relations group, headed by Margaret Morrison, KC7MA, who will be handling information requests and publishing a monthly newsletter. We are looking for volunteers to help with hardware and software efforts, especially people with appropriate backgrounds.

If you are interested in more information on any or all of our activities, please contact us at the following address:

Tucson Amateur Packet Radio
P.O. Box 22888
Tucson, AZ 85734

We are at a critical phase in our development as a group, and could certainly use as many members now as there are persons interested in packet radio. Your support at this time will make a difference in the acceptance of packet radio as a viable medium now and in the future.

73,
TAPR

FILE QST.82.06.12.0.N6ECT

To: All Interested Packeteers
From: N6ECT, Curtis
Date: June 12, 1982
Re: Question

What can be done now to increase packet activity and range when local network activity decreases and who can invest the

time?

Possibilities are HF contacts, VHF/UHF satellite contacts, or linking to the local VHF RTTY repeater. "Daylight Express" is still a possibility, but requires a lot of work and coordination. Spare time for implimenting these projects seems to be one of the basic problems, yet there still seems to be a desire to continue advancing the state of packet radio. So, how do we move to the next step?

HF packet seems to require more equipment, and is limited by the FCC due to transmission speed requirements and an Advance Class ticket. This limits the use of HF packet for the "mass".

VHF/UHF satellite packet, would apparently be the best of solutions for extending the range of contact, despite the problems of addressing and and "packet crashes". The coordination of a group of people to establish this kind of link would be tremendous, and would require a lot of selfless devotion to initiate; not to mention the necessity of friends in AMSAT, etc.

A local link to and from the local VHF RTTY repeater would be a nice way to extend the existing packet network and draw more attention to digital communications. Again the question of who has the time to do this work is raised.

I know that these are "old" topics, but I feel that they need to be "surfaced" from time to time, if we intend to keep growing in the world of packet communications. I do have one suggestion that perhaps could get this "ball" rolling. Based on your thoughts, we could address a message to all existing packet stations/nets polling information about who is interested in working in any of the above mentioned topics. This poll could then be maintained within each group, allowing users with special interests the ability of self initiative to contact others with similar or like interests.

FILE QST.82.06.12.1.N6ECT

To: All Interested Packeteers

From: N6ECT, Curtis

Date: June 12, 1982

Subject: Packet Radio in Sweden

PACKET RADIO at Linkoping University

A strong effort is being made to define and implement a packet radio data network at Linkoping University. The network uses a single wideband UHF channel (-200kHz at -400MHz) and transmission speed of about 100 kbit/s. The network is completely decentralized and each node is capable to act as a repeater. Long distance connections are possible through multi-hop routing. The routing algorithm is distributed. Programs can be transmitted over the network such that the user may implement

hir own service functions in distant nodes.

The network users are primarily radio and computer amateurs. Their participation will provide ample possibilities for large scale experiments. As the network has no built-in hierarchy, control is maintained through distribution (over the network!) of proper system software.

At present, suitable low-cost hardware is built and network functions are being defined.

Comments are highly appreciated and may be forwarded directly to Jens Zander or Robert Forchheimer at the following address:

Dept. of Electrical Engineering
Linkoping University
S-581 82 Linkoping
Sweden

FILE QST.82.06.13.0.N6ECT
To: All Interested Packeteers
From: Curtis, N6ECT
Subject: PACKET A LA NJ

The following message created by Gordon Beattie, WB2CAM and picked up on the Packet Radio Bulletin Board in Chicago at (312) 759-7005.

Just wanted to let you guys know that we're here in New Jersey doing all kinds of things related to packet radio. We have a two meter packet repeater on 146.535 using the Vancouver protocol and TNC board. We have a system of dial-up bulletin boards with on the air via Ham Radio testing under way. The software is available for free !! Just leave a note on :

R.A.T.S. 1 201-887-8874 (MIKE FRIEDMAN WB2WNX)
R.A.T.S. 2 201-785-3565 (GORDON BEATTIE WB2CAM)
The software runs on a TRS-80 model I or III under NEWDOS 80 V 2.0. In conjunction with other groups, we are developing a high speed packet system (RF and Computer) to run at about 48 KBAUD. We are developing a protocol which will provide virtual circuit service via packet radio. This is much superior to the present single hop, non-routed message forwarding technique. The protocol will first be brought up on the TNC boards that the Tucson Group has put together, but we are probably going to come up with a version for the Vancouver boards and naturally for our 48 KBAUD system. For some basic info on our protocol, you can contact us or read the CCITT recommendation X.25, specifically the sections referencing the level three (packet) protocol. If more information is desired we may be contacted at the above numbers or at 201-785-2324 (voice). Please understand that I am often not at home, but with reason feel free to call up until 01:00 or 02:00 depending on whether the next day is a work day!!
73, Gordon Beattie, WB2CAM

FILE QST.82.06.13.0.W4RI

To : All
From: AMRAD

On May 31, 1982, Dave Borden, K8MMO and I made a successful two-way 1200-baud packet QSO on 10 meters. We were both using VADCG TNC boards, Bell 202-compatible modems, and ICOM IC-701 hf transceivers in the ssb mode. It was no great DX working between Sterling and McLean, VA, but we learned a few things.

Dave and I are just far enough away (with a couple of mountain ridges in between) that direct 2-meter fm communications has not been possible the times that we have tried it. Normally, we communicate using packets via the 148.81/21 repeater which is sometimes noisy due to two causes: (1) Dave's not-full-quieting signal into the repeater, and (2) some repeater-transmitter-generated impulsive noise. So, on two meters, via the repeater, we usually have good packet communications but with numerous retries from time to time due to the impulsive noise. Also, we have learned that keeping the packets short (half a line or so) will usually minimize the number of necessary retries.

The 10-meter QSO, which lasted over 2 hours, wasn't like that. Even though there was quite a bit of background noise on both our signals, we were able to get most packets without retries. That's true for long packets as well. Some two-line packets made it on the first try.

We found that receiver tuning was a bit critical. The main problem is that neither of us had any tuning indicators on the modems. So, we used our ears and kept tuning the RIT control until it popped in. Stability was good enough that we were able to stay connected without retuning for around 45 minutes at a time before drift made it necessary to correct the RIT.

Some of the transmissions sounded lousy, like the proverbial rain-barrel effect, indicating some amount of multipath. The packets printed anyway. Signals were fairly steady in strength with only slow, flat fading at times.

Plans are to try some 2-meter F1 tests (actually F2j) using 2-meter transceivers in the ssb mode.

If anyone who is capable of putting a 10m signal into the Washington, DC area would like to QSO on this mode, please give me a jingle. Because I'm self-employed and can usually set my own schedule, I can handle a sked almost any time. The best number to reach me, days/eves/weekends, is 703-734-0878.

Will try to keep you informed.

73, Paul, W4RI

FILE QST.82.06.17.0.W4RI

To : All Packeteers

Subj: Call for Articles on Digital Modulation Techniques

At the AFCEA Amateur Radio luncheon on June 16, I had the chance to talk with Jan King, W3GEY. He asked whether QEX would be a good place to publish technical articles on digital modulation techniques such as QPSK and MSK. I recalled that Den Connors, KD2S and Steve Robinson, W2FPY had mentioned that they had some good written material as well as the possibility of generating an article. (Also, I just received via this channel a message from Den offering an article for QEX on "Modulation and Coding Techniques for Amateur Packet Radio," which I'm happy to accept.)

All I can say is that articles on QPSK and MSK would be particularly welcome at this time. Certainly, they are candidates for both terrestrial and satellite packet operations. Also, I sense a lack of knowledge on these modes by hams with a good appreciation of FSK and AFSK.

Both the AMRAD Newsletter and QEX can be conduits for articles such as these. The AMRAD NL is read by many packeteers in the U.S. and Canada. QEX has a larger circulation to experimenters in general and some packeteers. Both have some size constraints for economic reasons. But of the two, QEX is better able to handle more of the longer articles (e.g., four printed pages).

So that we can start "singing out of the same hymnal" on this subject, I include, below, some technical papers which you may wish to look up if you haven't already run across them:

Mathwich, Balcewicz and Hecht, "The Effect of Tandem Band and Amplitude Limiting on the Eb/No Performance of Minimum (Frequency) Shift Keying (MSK)," IEEE Trans. on Comms., Vol. Com-22, No. 10, October 1974.

Gronemeyer and McBride, "MSK and Offset QPSK Modulation," IEEE Trans. on Comms., Vol. Com-24, No. 8, August 1976.

Murota and Hirade, "GMSK Modulation for Digital Mobile Radiotelephony," IEEE Trans. on Comms., Vol. Com-29, No. 7, July 1981.

Simon, "A Generalization of Minimum-Shift-Keying (MSK)-Type Signaling Based Upon Input Data Symbol Pulse Shaping," IEEE Trans. on Comms., Vol. Com-24, No. 8, August 1976.

More good refs and/or an organized bibliography would be welcomed.

73, Paul, W4RI

FILE QST.82.06.18.0.W4RI

To : All
Subj: AMTOR

For your information, the text of the ARRL's Petition for Rulemaking to the FCC to permit AMTOR (CCIR Rec. 476-2) in the Amateur Radio Service is quoted below.

73, Paul, W4RI

Before the
Federal Communications Commission
Washington, D.C. 20054

In the Matter of)
)
Amendment of Part 97.69)
of the Commission's Rules) RM-4122
Regarding Radioteleprinter)
Codes Authorized in the)
Amateur Radio Service.)

PETITION FOR RULEMAKING

The American Radio Relay League (the League), the national non-profit organization of Amateur Radio Operators in the United States, hereby respectfully requests that the Commission amend Section 97.69 of its Rules to permit transmission by amateurs of the digital teleprinter code specified in Recommendation No. 476-2(1978) of the International Radio Consultative Committee (CCIR), known in the Amateur Radio Service as "AMTOR," in the amateur high-frequency bands. In support of its request, the League 1/ states as follows:

AMTOR

1. AMTOR is an automatic request-repeat radioteleprinter system which conforms to the standards of CCIR Recommendation 476-2. 2/ That standard was developed for the commercial maritime service, and has come to be known commercially under the trade name Sitor. To avoid confusion, AMTOR was coined as a term to describe amateur use of the method. Basically, a radioteletype station utilizing AMTOR transmits data in blocks of three characters, pausing after each to obtain from the receiving station either an acknowledgement or instructions to re-send. Microprocessor circuitry is generally used to automate the process. Because data transmission and acknowledgement alternate in a time-sharing manner, duplex frequency utilization is unnecessary. Both receiver and transmitter operate on the same radio frequency.

2. Perhaps AMTOR's greatest benefit is, by definition, reliable, error-free copy at the receiving teleprinter, and the certainty of the sending operator that the data has been received correctly. The automatic "hand-shaking" technique of AMTOR transmissions allows reliable communication even under marginal

and fading high-frequency propagation conditions. Conventional Baudot (International Telegraphic Alphabet No. 2) and ASCII (American Standard Code for Information Interchange) operators often must, under marginal propagation conditions, manually engage in time-consuming requests for repetition of portions of transmissions. Data is blindly repeated, or lost. With AMTOR, the equipment merely slows down during signal fades and resumes normal speed during periods of signal consistency. For this same reason, extended communications range is possible without error.

3. In the Amateur Radio Service, stations are required by Section 97.67(b) of the Commission's Rules to use the minimum amount of transmitter power necessary to carry out the desired communications. Use of AMTOR uniquely allows reduction of transmitter power to very low levels, because the effects of power reductions on sending speed are immediately obvious to the transmitter operator. Thus, use of low power and reduced interference potential are normal by-products of AMTOR operation. It will also be easy for third parties to ascertain whether a particular frequency is occupied by stations using AMTOR, as both the sending and receiving stations are continuously transmitting 3/ (at a .45 second rate) with an audible "chirping" sound. Inadvertent interference resulting from a third station being unable to hear one station due to skip conditions is precluded.

AMTOR Operating and Technical Characteristics

4. As mentioned above, the AMTOR error-correcting technique maintains error-free copy over a very wide range of received signal strengths. When signals are low, the AMTOR station simply re-transmits the same data until it is received correctly. Thus, the relevant factor in AMTOR transmissions is the sending speed. Because the sending operator has constant and immediate knowledge of the rate of message transfer without being so informed by the receiving station, signal strength per se is irrelevant.

5. As defined by CCIR Recommendation No. 476-2, AMTOR uses a 100 baud transmission rate. This is slightly higher than the 100 WPM (75 baud) Baudot speed, but less than the maximum 300 baud rate authorized for ASCII by present Section 97.69(b)(2) of the Rules. The FSK shift specified in CCIR Recommendation 476-2 is 170 Hz, the "narrow shift" commonly used for high-frequency radioteletype operation. Of course, other shifts are possible, requiring only adjustment to the FSK generator and RTTY demodulator being required. CCIR Recommendation 476-2 indicates an exact one-to-one relationship between ITA Alphabet No. 2 (standard "Baudot keyboard") and AMTOR characters. There is no built-in encryption feature, although commercial equipment manufacturers note the possibility of transmitting previously encrypted data over a CCIR Recommendation 476-2 link.

Amendment of Section 97.69 to Permit
Use of AMTOR is in the Public Interest

6. It is incumbent on the Commission, pursuant to Section 303(g) of the Communications Act of 1934, to "study new uses for radio, provide for experimental uses of frequencies and generally encourage the larger and more effective use of radio in the public interest." Perhaps the best medium for study of such new uses and experimental techniques is the Amateur Radio Service, due to its large number of innovative, technically oriented members. Thus, responsive to the above mandate of the Communications Act, the Commission has recognized as a basis and purpose of the amateur's proven ability to contribute to the advancement of the radio art." 4/ In the Radio Regulations promulgated by the International Telecommunication Union, the Amateur Service is defined 5/ as "A service of self-training, intercommunication and technical investigations carried on by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest. 6/

7. On January 30, 1980, the Commission adopted a Third Report and Order in Docket 20777, 7/ providing for and establishing rules governing the use of ASCII, 7/ providing for and establishing rules governing the use of ASCII, thus amending Section 97.69 of its Rules. Therein, at paragraphs 5 and 7, it was stated that:

5. In other comments, amateur operators expressed interest in using radioteleprinter codes other than Baudot or ASCII. Frequently cited examples were the Binary Coded Decimal (BCD), Extended Binary Coded Decimal Interchange Code (EBCDIC), Moore and Correspondence (IBM Selectric codes). It was also felt that the Commission should allow the use of various "computer" or "machine" languages for computer-to-computer communication; and that the rules should provide for experimentation in the use of "packet switching" techniques.

* * * * *

7. Our intent in this proceeding was simply to expand the operating capabilities available to amateur radioteleprinter operators by providing for the use of ASCII. We find, however, that the comments generally go beyond our proposal and seek more or less total deregulation in the area of radioteleprinter operation. We are not necessarily opposed to such extensive deregulation; and we agree that it would be in perfect harmony with the basis and purpose of the Amateur Radio Service as articulated in Section 97.1 of the Rules....

8. The deregulatory action proposed herein would be a further step toward removing unnecessary regulatory burdens on amateur experimentation which presently inhibit fulfillment of the amateur's obligations set forth in Section 97.1 of the Rules. The Commission charted the deregulatory course advocated herein in Docket 20777, and has continued to the same in Docket 81-699,

with respect to permitted teleprinter codes. The instant request would also grant to amateurs a tool of potentially vital importance in emergency communications. The savings in time and increase in accuracy in transmission of message traffic during emergencies allowed by the error-correcting characteristics of AMTOR operation make the public benefit of the instant request facially obvious.

Technical Specifications as Contained
in CCIR Recommendation 476-2 Should
be Adopted to Facilitate Monitoring

9. The Commission has recently proposed 8/ in PR Docket 81-699 the amendment of Section 97.69 of the Rules to permit the use of any digital encoding technique in the amateur frequency bands above 50 MHz. That proposal, if adopted, would permit the use of AMTOR on frequencies above 50 MHz. The instant proposal, therefore, proposes the use of AMTOR only on amateur high-frequency bands where Baudot and ASCII emissions are permitted.
9/

10. When the Commission authorized the use of ASCII in 1980 10/ it stated that:

Past experience with the use of Baudot Code in the Amateur Radio Service indicates that the vast majority of operators use common radioteleprinter standards, thus simplifying enforcement monitoring both by amateurs and our monitoring personnel. Thus, we are not adopting any further standards \other than maximum sending speeds}.

Beyond specifying in detail the transmission code to be used, CCIR Recommendation 476-2 sets forth precise specifications for transmission speed (100 baud), carrier shift (170 Hz) and block timing (0.45 second). Successful AMTOR operation depends upon nominal crystal stability of the transmission rate and block timing at both sending and receiving stations. An obvious question is presented as to whether these standards should be adopted as rules or whether, as in Docket 20777 pertaining to ASCII, only a maximum sending speed applicable to each band need be specified. So that no question should arise as to content monitoring difficulties by amateurs and Commission enforcement personnel, and to assure full compliance with Article 41 of the International Radio Regulations, 11/ it is proposed that the standard transmission speed and block timing be adopted exactly as specified in CCIR Recommendation 476-2 in the proposed amended Rule Section 97.69. The transmitter frequency shift may be simply limited to "less than 900 Hz," as is presently required in Section 97.69(a)(3) for Baudot transmissions. The attached Appendix sets forth the proposed rule amendments.

Conclusion

11. The proposed rule change will continue the Commission's

deregulatory effort in the area of Amateur Radio digital electronic experimentation, thus facilitating accomplishment of the amateur's duty to contribute to the advancement of the radio art. Since 1978, amateurs in the United Kingdom and elsewhere 12/ have experimented with AMTOR as a means of securing error-free teleprinter operation in the high-frequency bands. To date, some 40 amateurs are active with AMTOR. The Amateur Radio regulations of Australia, the United Kingdom and West Germany now permit its operation. Several U.S. amateurs 13/ have under Special Temporary Authority conducted experiments with AMTOR. It is the League's understanding that such authority has been renewed, and that preliminary reports filed by those experimenters are on file with the Commission. The consensus of those operators is that AMTOR does indeed provide nearly error-free transmission even with fading or otherwise marginal propagation conditions.

Wherefore, the premises considered, the American Radio Relay League, Incorporated respectfully requests that the Commission issue a Notice of Proposed Rule Making at any early date, proposing amendment of Section 97.69 of its rules to permit the use of the digital code specified in Recommendation 476-2 (1978) of the International Radio Consultative Committee, known in the Amateur Radio Service as AMTOR, in the amateur high-frequency bands.

Respectfully submitted,

The American Radio Relay
League, Incorporated

225 Main Street
Newington, CT 06111

By Christopher D. Imlay
Its Counsel

May 26, 1982

1/ The League gratefully acknowledges the extensive and helpful assistance of Mr. Bill Meyn, K4PA, in the preparation of this Petition.

2/ Attached hereto as Exhibit A.

3/ 20 Millisecond changeover time is typical.

4/ See Section 97.1(b) of the Commission's Rules.

5/ Article I, Section II.

6/ A similar definition appears in Section 97.3(a) of the Commission's Rules.

7/ FCC 80-35, 45 Fed. Reg. 8990.

8/ Notice of Proposed Rule Making, FCC 81-459, 46 Fed. Reg. 50993 et seq., released October 9, 1981.

9/ See attached Appendix, Exhibit C.

10/ See Third Report and Order, Docket 20777, 45 Fed. Reg. 8990.

11/ Article 41, Section 2, Paragraph (1) requires, inter alia, that amateur transmissions be made in "plain language". It is presently unclear how this requirement may be interpreted with respect to digital radioteleprinter codes in general.

12/ See Exhibit C, an article from the June, 1981 QST article discussing AMTOR.

13/ Id.

EXHIBIT A. (Copy of CCIR 476-2, from document entitled "Recommendations and Reports of the CCIR, 1978, XIVth Plenary Assembly, Kyoto, 1978, Volume VII, Mobile Services, Geneva, 1978, ISBN 92-61-00731-7,, under Direct-Printing Telegraph Equipment in the Maritime Mobile Service, (Question 5-2/8)).

EXHIBIT B. (As follows):

A P P E N D I X

PROPOSED AMENDMENT TO PART 97 OF FCC RULES

Section 97.69 Digital Transmissions.

Subject to the special conditions contained in paragraphic (a), (b) and (c) below, the use of International Telegraphic Alphabet No. 2 (also known as the Baudot Code), the American Standard Code for Information Interchange (ASCII) and International Radio Consultative Committee Recommendation 476-2 (1978) (also known as Amtor) may be used for such purposes as (but not restricted to) radio teleprinter communications, control of amateur radio stations, models or other objects, transfer of computer programs or direct computer-to-computer communications, and communications in various types of data networks (including so-called "packet switching" systems); provided that such operation is carried out in accordance with the other regulations set forth in this Part.

(a) NO CHANGE

(b) NO CHANGE

(c) Use of International Radio Consultative Committee Recommendation 476-2 (Amtor) is subject to the following requirements:

- (1) The code, baud rate and emission timing shall conform to the specifications of CCIR 476-2 (1978) Mode A or Mode B.
- (2) A1 and F1 emission shall be utilized on those frequencies between 3.5 and 21.25 MHz where their use is permissible.
- (3) F1, F2 and A2 emissions may be utilized on those frequencies above 28 MHz where their use is permissible.
- (4) When frequency shift keying (type F1 emission) is utilized the deviation in frequency from the mark signal to the space signal, or from the space signal to

the mark signal, shall be less than 900 Hz.

FILE QST.82.06.19.0.N6ECT

RECORD FORMAT: ---

To: All Interested Packeteers

From: Curtis, N6ECT, PPRS@SFO

Date: June 19, 1982

Subject: R.A.T.S. N.E.S.T. System 2

Just in case that you are into telephone BBS calling, and want to save some time and money, I have entered below the logon format for WB2CAM, Gordon's BBS in New Jersey at (201)-785-3565.

TYPE \CR} REPEATEDLY UNTIL BAUD IS ACKNOWLEDGED
(XXXX) baud entry ;where (XXXX) = 300/1200

Enter last name or ID number-

Enter first name -

Checking user log, please stand by...

Where are you calling from -

What is your phone number -

Is this correct (Y/N) ?

Adding you to user log, please stand by...

Updating Activity log, please stand by...

Welcome to R.A.T.S. N.E.S.T. System 2

Located in Little Falls, N.J.

Operated by Gordon WB2CAM

This system is dedicated to the dissemination of information pertaining to Amateur Packet Radio.

Other topics such as computers, telephone systems, and related subjects are also welcome.

If you have trouble using the system, type 'HELP' after the 'COMMAND ---|' prompt.

If you wish to have an ID for the system (It is required to 'Receive Mail' but not to 'Send' it.) or have a question, type 'Send' and the system will prompt you for the rest. Note: if the message is to be private it must be directed to a person with an ID and requires the execution of the 'Mail' command before the 'Send' command.

Good luck and thank you for your interest.

SYSTEMS: (MAIL) (BULL)etin board (DISC)ussion

COMMANDS: DIR	ECHO	(ERA)se
(RE)ceive	(SE)nd	(SYS)tem
HELP	(ED)it	LOGON

(TER)minate TIME

(PHO)ne #'s

To select a system, type it's name.
You may abbreviate commands to the letters shown in parenthesis.
(It is no longer necessary to place the system name
along with the command, although that mode is still supported.

The system has a new and more concise COMMAND prompt.
It is a '-|' and will replace 'COMMAND ---|'
Thanks, Gordon WB2CAM

Type a '?' for a menu of commands.

The rest is fairly simple; for example, to read the bulletins,
when you see the prompt type:

-| BULL [-
SYSTEM = BULL (will appear)

-| RE [- (to read the bulletins /also/ the '[-' is a
system prompt, and not to be typed)
Press P to pause, press A to abort. (will appear)

(M)ultiple (N)umeric (T)o (F)rom (S)ubject - (will appear; I
entered 'M')

Starting number? (will appear; I entered '1')
and the system will begin to dump the bulletins.

I hope the above information will be useful and save you
some time.
73, N6ECT, Curtis

FILE QST.82.06.25.0.KA6M

Date: 25 June 82
To: All Packeteers
From: Hank Magnuski

I am about 95% through testing new versions of the LIP/TIP and
KA6M/R software which does away with hardwired ID codes. The
strategy is an expansion of the AMRAD suggestion to put the
callsign at the front of each packet. Each packet will have a
header of the following form:

FLAG ADDR CTL FMCALL TOCALL ID0 ID1 Infofield FCS FLAG

Where

ADDR	Assigned always to some fixed value. I'm using FE.
CTL	All current values unchanged plus the addition of Repeater connection reject packet Station connection reject packet Broadcast packet
FMCALL	7 bytes of callsign of the originator
TOCALL	7 bytes of callsign of the desination

ID0, ID1 Two bytes to indicate the protocol being used at
the next higher level, level 3.
Info Usual information field

The rules for operation are very simple:

A link-level packet going from A to B will have CALLA and CALLB in the header, with no exceptions. This applies to the repeater as well, which keeps a table of how to redirect packets. All packets transmitted by the repeater have its call in the FMCALL field.

I will have more details later, but I feel that this format solves most of the problems which have been aired recently, and solves problems which are currently restricting our growth. I'm open to midcourse corrections, but they better come before we get all our EPROMs burned! The strategy allows multiple repeaters on the same frequency in an RF domain, it allows direct point-to-point contacts, and allows AMSAT to use PHASE IIIB without any person coordinating the addressing codes. I will put LIPM04.ASM and TIPM04.ASM on this medium when I feel they are adequately tested.

See you when I get back from my vacation (July 12th).

73, Hank

FILE QST.82.06.27.0.KD2S

to: all groups
from: TAPR

After several hours of transmission of test packets, Lyle Johnson WA7GXD successfully initiated the first amateur packet radio contact with all-American hardware and software, using the Tucson Amateur Packet Radio Corporation Terminal Node Controller (TNC), at 9:12PM MST, June 25th, 1982. At the receiving end was Den Connors, KD2S, who was co-located with Lyle at the WA7GXD station.

The two-way contact lasted for about one hour, during which time several different experiments were conducted to determine optimal selection of components for the TNC modem amplifier/filter set.

Within twelve hours of first QSO, the experiment was repeated over a distance of about twenty miles, from one side of Tucson to the other, over conditions which were as bad as "less than S1", with total success. Tucson's first packet "rag-chew" lasted about 45 minutes, with different antenna and signal-level combinations attempted by Lyle and Den.

Also at the first transmissions were Marc Chamberlin WA7PWX, the TAPR Software Chairman, Margaret Morrison KC7MA, the TAPR

Publicity Chairman, and Heather Johnson N7DZU, a member of the Publicity Committee.

These tests culminate hundreds of hours of effort on WA7GXD's part, who has spearheaded the design of the TNC as Hardware Chairman. Completion of modifications to the on-board modem next week will allow Lyle to release a final version of the TNC to a local Computer-Assisted Design firm for the artwork and construction of TAPR TNC Beta boards, which are slated for a July release.

In parallel with the hardware efforts are those of WA7PXW, who has been using a Point Four minicomputer as the development system for TAPR TNC software. Marc has completed the simulation of interfaces between the TNC and an attached terminal, as well as between the device and the radio link. On the link side, normal user operations, net control functions and digipeater operations have all been successfully simulated.

The FORTH software will be loaded into an Apple microcomputer for final debugging, and then loaded into an AIM65 micro for PROM-burning. Expected arrival of TAPR Beta systems into the first ten U.S. and Canadian cities for phase one of beta test is due in five to eleven weeks.

KD2S, President
Tucson Amateur Packet Radio Corporation

FILE QST.82.07.04.0.N6ECT

**** ULYSSES S. ASCII

Full permission for reprinting or quoting items given by the Amateur Radio Research and Development Corporation c/o Paul Rinaldo, Editor, 1524 Springvale Ave., McLean, Va. 22101 & Ada Dee for "The Inventor". -cas-

According to most commentators, Ulysses Sandor Ascii was born in Rahway, New Jersey on February 2, 1903. His date of birth remains uncertain due to the unfortunate fact that two commentators, Hilda B. Ascii and Bruno Lollomalopalado are now deceased.

Miss Ascii continually claimed that she was the eminent Dr. Ascii's daughter, but no evidence has surfaced to legitimize her claim. Prof. Lollomalopalado is remembered by some as the foremost historian of Hawaiian culture in New Jersey.

Ulysses' parents were by all accounts immigrants from the Breaker on Yllivvin in Walse. With all their earthly belongings and four ham sandwiches, they boarded the ill-fated steamer H.M.S. Bempley some time in 1889 and travelled steerage to the Port of New York. Legend has it that an immigration official recorded the family name as "Ascii" as a truncated derivation of the actual name, recorded in the register of the St. Fidgeta's Church, Breaker on Yllivvin as "Askew". The father is recorded in the same place as Pellew D., named his son for Ulysses S.

Grant and is believed to have maintained that Grant was President of the U.S. for most of his life. The senior Ascii deified Grant, and his picture is said to have hung next to that of the Tsar while the family still lived in Walse.

Pellew D. Ascii settled his young family in Rahway, attracted by its Hawaiian culture and Old World manners. Sundry newspaper files report that he died minutes after Ulysses' birth. The cause of death was given as shock.

Ulysses reputedly left home at the age of eleven to study communications theory with Prof. Flanders Watthour, K.C., the leading psychic medium in the Rahway-Elizabeth community. Together, they outfitted an expedition and established the Secret Pellew Colony in Union City, N.J., in 1916. Some of their earliest communications experiments are still positively recalled in various taverns in Union City and Weehanken. The colony was forcibly disbanded by paramilitary vigilantes in 1920. Brought up on charges involving the allegedly obscene rites of the colony, Ulysses was returned to Rahway where he completed his education as a guest of the state. Prof. Flanders Watthour (q.v.) disappeared with most of the papers and written records of the colony.

A few fragments were recorded at high tide in Bayonne, N.J., quite by accident when an ESSO oil barge struck what appeared to be a cement buttress. Upon closer examination, it was found to be an earlier attempt to construct Grant's Tomb according to plans drawn by a relative of Cornelius Vanderbilt. Beneath the tomb was a leaden box which was covered with mystical symbols and signed by Emil Baudot. The box contained detailed drawings which, upon examination by the entire faculty of Columbia University in the Spring of 1951, proved to be the incoherent crayon scribblings of a man named (fnu?) Murray (lnu?).

U. S. Ascii studied with Dr. Bruno Lollomalopaldo and the Rev. Alexander Babafaray, fellows of Rahway state as well. Letters ascribed to Ascii's maternal uncle Pincas M. Basarab of Shamokin, Pa. tell little of his studies. Envelopes show that Ascii gave his return address as Penn. State instead of State Pen., probably to save the family's name.

After graduation from "Penn. State," Ascii's career demonstrated considerable misdirection. His only known novel, set in Secaucus, N.J. and titled, "Not a Pig Left Anywhere," was put into type by inmates at his alma mater and sold only three copies, all to his uncle Pincus.

Details of his life after this point became sketchy. We are able to surmise only after the experience as a failed author, Ascii moved to Baltimore where he took to the sauce. He was known for his preference in imported wines (Balihi mostly, Ripple when he could get it).

Ascii became increasingly despondent during this period and

took to long stays around Baltimore wharves where he amused himself by gambling away the little money that was his. To pass the time of day, he spent odd hours in Engine Company No. 5 devising Fire Codes. His one-alarm, two alarm, etc. system caught on and was eventually recognized by the National Embers Society.

In 1933, he was one of the players in a historic game of liar's poker at Windy Paradise Cafe on Water Street involving two fellows named Ebb Cedick and Rene Wei Paquet, who claimed that he had a "code in the node." Using his own method of beating the system (the Chinese remainder theorem) Ulysses won a used Philco radio with only one knob missing. In reconstructing the damaged apparatus, he stumbled onto vital principles of electronics and mathematics. His career took a turn for the worse when a patent based on these ideas was turned down. Later students of Ascii discovered that the devices were the 1001 and 2002 processors, something that Intel wishes could be left out of history books.

He also invented a new optional seven or eight hole (or no-hole) code with unique assignments for everything he found on a discarded typewriter which was missing the fraction key. On the (free) advice of former patent attorney, he filed a trademark application, which was thrown out by the patent office as a frivolous application without merit. The same code was later submitted as someone else's work and eventually adopted by the ANSI X3 committee. Ulysses finally achieved recognition in 1968 when the X3.4 Task Group voted to name their code "ASCII," but not without many grueling night sessions to expand the 'acronym' to American Standard Code for Information Interchange. Ascii finally achieved parity by having his name on his original invention.

Back to the early days of Baltimore. Falling again into despondency, he threw his lot in with the mystical, migrant, bandit gypsy, Tungar Gesohnetten. As a member of his band, he lived in the Jersey Pine Barrens, living off the land and robbing travelers until routed by an expedition of state police led by Lt. Ungar Throughput.

Convicted and sentenced again to Rahway, he became a tenured professor and is known to have taught classes in Meat Science, Greek Athletics and Electronics. Some accounts have it that he married a cafeteria employee, Kay Nada, but no proof of this bond has thus far surfaced. Ulysses Ascii collapsed and died at Rahway on November 4, 1969. Medical examiners recorded that he choked on a prune pit but that foul play was suspected.

His remains were interred in the Hudson River, down wind of Bayonne Harbor by citizens' petition. He lies today near the same mystic monument to General Grant, his namesake. For further reference, consult "Sternwallow's Annals IX."

HAVE A HAPPY 4TH.....DE N6ECT

FILE QST.82.08.10.0.KA6M

To: All packet stations
Fm: Hank Magnuski, KA6M
Date: August 10th, 1982

I have collected several responses to my short note about the new packet layout, and would like to pass them along to others. Thanks to all who supplied comments. I have not had time to formulate any responses to these suggestions. 73, Hank

FILE ka6m.fm.n6gjh

Hi Hank. It would be nice if you were to increase the size of the packet somewhat, if only to compensate for the additional overhead. My reason is somewhat selfish, but I'm sure that it would be important to other CP/M people: CP/M uses 128 byte records. When sending .COM files, it would be nice to be able to receive a record at a time, simplifying programming and allowing some of the hookups (like mine) to work without too much crap. Can the TNC handle it? How about just jacking it up to 256 bytes instead of 128, just to keep it power of two and allow for any new stuff we may do later, especially with weird routing codes or whatever. Anyway, just a thought. If you get this before you leave on your vacation, how about dropping a note re next packet meeting?

Talk to you later, Rick

FILE ka6m_fm_gnu.jul.10

Hi Hank, John here...

Just saw your message about new versions of LIP/TIP and repeater. Two brief recommendations: first, a TIP feature which would have a bit table and/or a user settable timeout for packet transmission triggerings. The command `~( would begin the list of delimiters; thereafter each typed character would have a bit turned on in the ' table of delimiters. `~) would exit this mode. Thereafter whenever a character was keyed which had its bit on in this table, a packet would be sent. (This is the general case, user settable version of your KA6M** tests for colon, etc.) A third command such as `~~` would clear the bit table. The timeout would be specified with a set of digits (followed by any nondigit) after a `~t command (as in "`~t50 " to set the timeout to 50 tenths of a second). If any character has been keyed but no packet has been sent in that much time, the packet is sent on as-is. This is ' the preferred delimiter method for computer output since it tends to come out in bursts, but with no fixed delimiters. Setting the timeout to zero would disable it. Note that the keyed characters can only be edited locally before the

packet is sent, so such editing is unreliable when the timeout is set. This is usually OK if the remote system also implements simple backspace (or delete) editing. I don't know if TIP accepts both to do the same thing; it should. It should also transmit them if they are keyed at the beginning of a buffer (with no chars keyed) incase the previously sent text is now being rubbed out. Probably the timeout set by the user is good enough to kick out these rubouts from the input buffer; they don't need to be expedited.

|The second thing to consider is that, on very brief reading, your new format for headers does NOT make forwarding via a repeater transparent, possibly losing the ability to forward thru multiple repeaters, since al (all) packets transmitted from repeater A to repeater B, no matter who they are ultimately for, must be sent with "A" and "B" in their fields. This takes up further space in, and requires, a higher level protocol to deal with routing. I suppose it's a good first step, I just hate to think of changing all those proms again later. Can you put a few RAM hooks into the system? That is, indirect subroutine calls thru a transfer vector in RAM which the ROM sets up at RESET and which can be patched to cause new things to occur, at those particular points in the processing that we thought of BEFORE we burned the ROMs. The corollary is a patch facility, which I think can safely require a computer on the other end (use binary images instead of typing in hex or something, for ease of implementation). Two commands would be required, one (probably ~ followed by some control character) which would begin a download from the terminal side, followed by a 1-byte length, 2-byte address, and n-byte data, followed by normal text. The length is limited to 31 bytes so that if the user accidentally invokes this command, the length they supply would probably be invalid, if it was a space or alphabetic. The second command would enable (~d for lack of a "TIP Reference card" to pick an unassigned letter) or disable (~nd) downloading of packets with patches in them. A particular packet "Protocol" field, say 1, would invoke the patch code. The information field of the packet would contain an address, data, and checksum (simple 8 bit sum) of the patch. Checksum prevents random packets which are not truly intended as patch packets from passing. The data is just moved directly from the packet buffer into the specified destination. Care must be taken to move only the exact number of bytes specified, so it can be used to make "delicate" patches of 1 or 2 bytes in transfer vectors. The default state of the TIP/LIP should permit downloading; the repeater can be programmed at some point to periodically or on request transmit the current set of patches to implement the next level of protocol we design, and these can run out of RAM on systems with old proms. The transfer vector entries I can think of are:

Packet Received from 8273 in good shape

Packet ready to transmit to 8273 (with buffer space available to move it around, if it needs expanding. This probably means "Not in the interrupt routine").

Unknown command from TIP input (~~x where x undefined).

I believe we can already patch interrupt vectors as they are in RAM, yes? If not, indirect each interrupt routine thru a RAM location so it can be patched.

This will give much flexibility in future development without redistribution of proms. And will also correct the few outstanding complaints about TIP and solve a DG performance bug while adding a general feature. Wish I could do these myself but time and lack of equipment presses me to hope that you can find them pretty easy to slide in.

It has just occurred to me that I can make the Ron Cain Small-C compiler available on my Unix system at Sun, to generate 8080 assembler input from C programs (which can probably be debugged under Unix C for ease). Small C lacks quite a number of features from C, but is a useful subset, is public domain, and is being continuously enhanced by the general public (see Dr. Dobbs' Journal, where new updates to it tend to be published.) I have it online at MIT and can download it. Then if a packet system becomes available to be put online to the Unix system (and can reach the repeater from Santa Clara), it can be put up as a second host on the net, and can be used to do development and subsequent downloading into VADCG boards or later TAPR boards. The amazing professionalism of the TAPR effort amazes me; I hope they can keep up the time required to get their system totally out into the world. I figured it would take much longer to get "turnkey" packet radio stations out into the world; it still will, because of radio interfacing and licensing requirements, but two major parts (hardware building and debugging and cpu-modem purchase and connection) have been eliminated, or hopefully soon will be. Maybe before another 2 years I can run a packet station. (Tho actually at Sun I spend a lot of time around hardware people, and have learned a lot...maybe could debug another bare board now. But don't want to....have too much software that needs doing anyway. I can wait for the turnkey stuff.

Keep in touch.....

John Gilmore. work phone 408-748-9900, usually there.

FILE ka6m_fm_wa6jtz.jul.15

Hank I just recieved this through a DL thought you might be interested.

01932 00024 US

Date: 15 July 1982 12:27 pm EDT (Thursday)

From: Sewhuk.HENR

Subject: Re: Packet Radio Internals

In-Reply-to: Article-I.D.: houxc.225

To: HamRadio~.es

Reply-To: Sewhuk

Relay to decvax!harpo!npois!houxi!houxc!ad7i
and or Hank Magnuski but there is
a brain damaged mailer somewhere so hope this works.

I found some things that I think are really bad in your header
format.

1) The FROM and TO fields are backwards. Why make your node
filter through the FROM field first. You can more quickly
determine if it is your packet if the TO field is first.

2) Remove all, underscore, bold italics control information
from the header.

Why would any node want to know about that? It really simplifies
the code of the repeater node if it only has to resend the info.
If the control info was encapsulated in the information field,
the consenting packeteers would be able to strip that out of the
info field. Why clutter up that level with useless information.
Makes more sense to me to put protocols in the info field, that
way you can experiment with new, improved protocols in the
information field without confusing your repeater/gateway nodes
in the interim.

3) What is the 7th byte of the call?

I hope is it a socket number. I think that maybe the callsign
fields should be variable length, end each field wiht bit 7 set
high to denote the string. Then your headers can be shorter when
you are talking between stations with 1 by 2 or those new fangled
2 by 1 calls. ASCII is an inefficient way to do it, RADIX 50
would be better, but ASCII is easier for sure.

If you want more info, my radio club in Buffalo has been
thrashing out the header format and repeater/user interface
formats for a while now.

Let me know if you get this, I think sometimes one of your
machines digest these messages without my acknowledgement or
yours.

Dave

FILE ka6m_fm_n6fqr.jul.15

Hank,

Here is a message I got from a fellow xeroxer back East. The
discussion started when I (and some others) sent him your QST

message describing the new protocol. Ron sent you his initial message. He is another where he gives some more of his ideas.

Bill

Date: 15 July 1982 4:18 pm EDT (Thursday)

From: Sewhuk.HENR

Subject: Re: Packet Radio Internals

In-reply-to: Danielson.pa's message of 15-Jul-82 11:48:11 PDT (Thursday)

To: Danielson.pa

cc: Sewhuk, RBrown.pa

I would send ad7i stuff directly but laurel points at the To: line and says there is an error in it somewhere, I can't see any, if you can tell be what incantation it took to send that, let me know.

I understand that that is the header used to connect two people together with, not a "gateway" header. You may and probable would like to have a different packaging scheme to connect gateways together in the future. For the present we won't have enough geographical coverage to even consider gateway-to-gateway communications. I think it is important to have a standard, ala-pup way of connecting two stations together. If this method is reasonably done, we can later grow into gateway handled traffic, mail, file transfers, etc.

The things done now should be as general as possible to allow experimentation by a Saturday afternoon TRS-80 owning guy who knows little about packets and programming with enough room to grow in the future. Putting little "repeater reject" fields in the wrong way to go. Things like that get inadvertantly made into standards and it becomes a thorn forever more.

The simple header: to from length checksum is the best way to go. Everything else can be added later after the length field. A simple implied routing scheme that in the future can be eliminated if desired is the best first cut I can see. In that I mean uucp-like routes of the form:

W6RPT!WA6JFZ W6RPT!N2GH leng checksum.

With a format like that, which is a simple extension of what I have see so far, you can describe a routine through a repeater. By appending a letter to everyone's call you can even describe a path through your own repeater. If you think that you can get routing, a repeater program, terminal interface programs running all concurrently, my hats off to you. Our group felt that was a

bit too ambitious. A repeater's property is that you strip the first field off the TO, re-transmit what left. There is other stuff that can be done, like assuming you reverse path is the same as the forward path, i.e:

W6RPT!WA6JFZ "!N2GH leng checksum.

Mostly to shorten headers. An example using "socket numbers " this time of talking to you through my repeater:

N2GHR!WA6JFZO N2GHR!N2GH0 leng checksum.

With the techniques I have seen to date, there is no easy way to describe this connection without building all these "bags"/"kludges" into the header structure, making us implimentors write many more lines of code, etc.

In summary I see two issues that maybe getting confused:

- 1) The low level how do two people communicate to each other.
- 2) How will he leave his local network to go to bigger and better places.

I think we should look at issue 1 very closely now, it could last a suprisingly long time until we reach the critical mass to address issue 2's problems. For instance my "gateway" (N2GHG a possible name) could have the property of looking through the info field for more routing stuff, latitude, longitude, commands, etc. I don't see that coming 'til we blaze more trails and reach a critical mass of users going.

Let me know what you think, what others think, I personally think that most of what has been happened has been done on whim without looking far enough into what you want to happen. No doubt their stuff works, why else would they be pushing it", but looking past that I see a potential can of worms forming.

Dave

FILE QST.82.08.10.0.VE3QB

General Message

The project to be developed here in Ottawa for the 1982/83 season, and probably 83/84 as well will be a microprocessor based VHF METEOR SCATTER communications system. Planning for this has been underway since early this year and a test program will commence in early spring '83. Participation in other packet radio projects has been suspended for the duration.

To maintain contact with you (beyond this medium) I have just started to wire wrap up the AMTOR project on a card. Who else out there is using AMTOR? I need the ASSEMBLER listing for the 6802 G3PLX software - has anyone got the listing on this side of the ATLANTIC yet? Is anyone really on 14.076 with AMTOR ????

What activity is expected to grow using AMTOR - opinions will be appreciated.

David, W6RAW - Please QSP to your UNIX contacts - I would especially appreciate comments from W8SDZ.

Larry Kayser,
VE3QB/WA3ZIA

FILE QST.82.09.08.0.N5AHD

To: All amateur satellite publications

From: Robert J. Diersing, N5AHD

Date: September 8th, 1982

Subj: Transmission and reception of digital packet data via
Amsat-Oscar-8, amateur radio satellite

In recent weeks, Dr. Tom Clark, W3IWI, of AMSAT and myself decided to begin testing the feasibility of transmitting and receiving packet radio data via satellite. We are both using the Terminal Node Controller (TNC) boards produced by the Vancouver Amateur Digital Communications Group (VADCG). Software was supplied by AMRAD, originally written by Doug Lockhart, VE7APU, and modified a great deal by AMRAD.

After several unsuccessful attempts to receive connect sequences from Tom via mode A we decided to abandon the two-way attempt and I would try to receive my own data. Since I already had three TNCs and two 1200 baud modems available, I would try sending QST packets and receiving them on another system. A small software modification had to be made such that the QST message and CW id were transmitted continuously rather than at 9 minute intervals as allowed by the original software. Better audio matching between modems and radios was also incorporated and testing resumed.

After several unsuccessful attempts, on September 1, 1982, 01:10 UTC, (an experimental day) orbit number 22887 mode J (or possibly AJ since I was not listening on mode A), digital packet data was transmitted and received at N5AHD. In some cases, the three line QST message was partially received and in others it was complete. The mode of transmission was NBFM in the middle of the satellite Mode J passband. At any time the signal was good quieting and the tuning for zero discriminator reading maintained, the copy was successful. No tests on SSB were made during the orbit.

Later, on September 6, 1982, 14:00 UTC, orbit number 22938, with satellite in mode J, several more successful receptions were made this time via SSB. The tuning in this mode was much more difficult which was expected. The number of complete packets

received was much lower than when using NBFM probably due mainly to the better tuning indicator via the discriminator meter.

Needless to say, much more testing is planned and the results of those tests will be documented. This first iteration was simply to get HDLC packet data through an amateur satellite in low orbit successfully.

FILE QST.82.09.18.0.W4RI

TO : All

SUBJ: FCC Approves Additional Digital Codes

Below is some news as it will appear in the October 1982 issue of QEX:

On September 14, 1982, the Federal Communications Commission (FCC) approved Docket 81-699 (proposed rule making to allow additional digital codes in the Amateur Radio Service). When this item came up, Commissioner Henry Rivera asked whether mention of enforcement in the document before them indicated any unresolved concern on the part of the FCC staff. The answer was that the document simply repeated some of the wording used in the notice of proposed rule making and that everyone realized that the FCC would not be able to monitor all digital transmissions for message content. Chairman Fowler asked if off-the-air sample recordings of unreadable transmissions could be made for later analysis and whether the amateur station could be requested to furnish the information which would allow the FCC to decode the message. Field Operations Bureau Chief, Richard Smith answered "yes." Private Radio Bureau Chief, James McKinney pointed out that the rule change applies to vhf frequencies which propagate more or less line of sight. Also the FCC has the right to close down any offending station. He said that the Amateur Radio Service has an excellent record of self policing. All of this happened in less than ten minutes.

This action is in response to a petition by the ARRL to amend section 97.69 of the FCC rules to permit the use of new and experimental digital processes by radio amateurs. (See "Happenings" in the December 1981 QST.) Currently, the only digital (RTTY) codes authorized for amateur use are ASCII and Baudot.

I do not know exactly what the new rules will say because they are not released until they appear in the Federal Register. But I have a pretty good idea. It will permit the use of any type of digital code above 50 MHz for domestic communications only (also probably to Canada and Mexico if they agree). Stations will still need to identify using voice or cw and will need to maintain a log of the codes used and furnish that information to the FCC upon request.

The original petition by the ARRL requested increase of permissible speed from 1200 to 4800 baud between 50 and 225 MHz. The FCC's notice of proposed rule making proposed that sending speeds up to 19.6 kb/s may be used on ASCII (unspecified speed on additional digital codes) so long as the bandwidth did not exceed 16 kHz. Comments filed by AMRAD suggested that the speed (particularly in the 220-MHz band) be raised to 56 kb/s and that bandwidth be increased to 100 kHz. The League filed comments in support of this and a similar request by Paul Newland, AD7I to raise the limits above 420 MHz. So, at QEX press time, we have to say that we don't know the speed limits in the new rules. But we should know within a few days.

The maximum bandwidth and/or speed is particularly important in the development of a packet radio backbone network (internet) which will connect between cities. If it is too slow, the network trunks will not have enough capacity to handle peak traffic loads.

At this point, if the new rules were effective tomorrow, we would have a difficult time finding high-speed modems. Someone's rule of thumb said that modems above 1200 cost something like a buck a baud. Today's competition seems to be driving the commercial ones down to about half that. Even at that, the price is awful and will drive us to home-brewing. Among those of us who have been discussing high-speed modems, there is no agreement (yet) on the best type of modulation to be used. Leading candidates are: msk (minimum-shift keying where the shift in Hz is half the baud rate) and qpsk (quadrinary phase-shift keying).

Packet radio experimenters with Vancouver terminal node controller (TNC) boards have been using non-return-to-zero inverted (NRZI) encoding. NRZI is no longer considered to be state of the art in the computer industry and is being replaced by others such as Manchester and Miller encoding for magnetic storage media. One characteristic of some of the more sophisticated encoding schemes is ensuring of changes of state often enough that the dc component is eliminated. Bob Carpenter, W3OTC, raised the possibility that the right encoding scheme could permit transmission of data without a modem by feeding the data stream directly into the microphone input of a transceiver.

The FCC action clears the air for us to experiment, at least above 50 MHz, with forward error correcting (FEC) codes. There hasn't been a pressing need for them to date in the handful of amateur packet radio networks in North America which are mostly local in coverage. High-speed inter-city paths which are long enough to encounter fading on vhf could be good test beds for certain types of error-correcting codes.

Docket 81-699 applies only to 50 MHz and above. It will not change the situation on hf where we are currently limited to Baudot and ASCII codes. The League has petitioned the FCC to permit "AMTOR" transmissions in the hf bands. That petition has been designated RM-4122. (For details see QST August, 1982.) At

the moment, AMTOR is in competition with Docket 82-83 (NOI/NPRM for phone subband expansion, see September, 1982 QST, p.10) for FCC time. Because of the present FCC backlog and finite resources for handling rules changes, other hf data communications experimentation should go the special temporary authority (STA) route for now. A permanent rule change affecting the hf bands is a more complicated procedure than at vhf and above because the signals easily propagate outside the U.S. This makes it necessary for the FCC to be careful that international treaties and ITU regulations are observed.

As you may have heard, the President signed into law certain changes to the Communications Act of 1934 which included those requested by the League. That happened the evening of September 13. If that followed in less than 24 hours with the FCC passing Docket 81-699 doesn't signal a new ball game for Amateur Radio, tell me about it.

73, Paul, W4RI

FILE QST.82.09.24.0.W4RI

September 24, 1982

To: Members of ARRL Committee on Amateur Radio
Digital Communications

Enclosed is a copy of the FCC's Report and Order on PR Docket no. 81-699, Use of additional Digital Codes in the Amateur 97.69(b) (2) on page 2 of the Appendix, about 3.5 inches from the top. I think that it should have read "28" instead of "29" MHz. I have informed Chris Imlay who will bring it up with the FCC. I suggest that you look this over carefully and let me know what you think of the new rules above 50 MHz. Still pending is a rule change to permit AMTOR in the hf bands.

Also enclosed is a copy of a letter from Wally Linstruth, WA6JPR. I would appreciate your thoughts on these subjects and any others that you think should be considered by the committee.

Finally, there is a copy of a "News from Washington" column in a recent IEEE VTS periodical giving an executive summary of an FCC PRB document, "The Future of Digital Technology in the Private Radio Services," for your information.

73,
Paul L. Rinaldo, W4RI
Chairman

In the Matter of	)	
	)	PR Docket No. 81-699
Use of Additional Digital Codes	)	RM-3788
in the Amateur Radio Service	)	

REPORT AND ORDER
(Proceeding Terminated)

By the Commission

1. On October 1, 1981 the Commission adopted a Notice of Proposed Rule Making 1/ in the above-captioned matter proposing to allow amateur radio stations to use digital codes, other than those specified by the Commission, on amateur radio frequencies above 50 MHz. That Notice was in response to a petition for rule making, RM-3788 submitted by the American Radio Relay League, Incorporated (ARRL), which seeks amendment of the Amateur Radio Service Rules (Part 97) to provide for the use of any digital encoding technique in the amateur radio frequency bands above 50 Mhz. Currently, the Rules only permit the use of the International Telegraphic Alphabet Number 2 (Baudot code) and the American Standard Code for Information Interchange (ASCII code). The comment period for the Notice ended January 15, 1982 and the reply comment period ended February 15, 1982.

2. In its Notice of Proposed Rule Making, the Commission specifically proposed to permit the transmission of digital codes, other than those defined in the Rules, on all amateur radio frequencies above 50 MHz, with the exception of those frequencies designated for A1 emissions only (50.0 - 50.1 MHz and 144.0 - 144.1 MHz). It was also proposed to limit communications using such codes to those between points within areas regulated by the FCC (domestic operation). Requirements that a station licensee include a description of the unspecified digital code in the station records and that the licensee, upon direction of the Commission, cease or restrict the use of the code, or maintain a record of coded communications, were also included in the proposal. In related areas, the Notice proposed to raise the maximum sending speed for ASCII coded communications from 1200 baud to approximately 19.6 kilobaud on amateur radio frequencies between 50 and 225 MHz; but it was also proposed to specify this higher speed, as well as all other sending speeds, in terms of "bits per second." The proposal included bandwidth specifications for transmissions of ASCII coded communications between 50 and 225 MHz, and for all transmissions of communications using unspecified digital codes. Finally, the Commission proposed to allow the use of A1 emissions for the transmission of ASCII coded communications on frequencies between 3.5 and 28 MHz.

3. Virtually all of the comments on the Notice support the Commission's proposal, however many suggest minor modifications. John A. Carroll, in his comments, quotes the following portion of the Commission's Notice: "We believe that the other unspecified digital coding techniques may also lend themselves to digital voice, facsimile, and television communications. As such uses are not currently prohibited by the rules, the Commission does not see a need to restrict these uses for the unspecified digital codes." John A. Carroll's comment

goes on to state that certain of these uses have "... enormous potential for improved communication, especially relay communication...." and that "... it would be well to add a few extra words (to the final rules) so that there is no doubt about (this) intent." Since the Commission desires to set forth the rules in the clearest possible manner and also desires to foster experimentation in the Amateur Radio Service, we are including such additional language in the final rules.

4. With regard to our proposal that communications using unspecified digital codes be limited to domestic operation only, the ARRL, petitioner in RM-3788, states in its comments, "There is at present a great deal of interest in linking together packet repeaters between Canada and the United States. The League would suggest that the final rules for additional digital codes provide that, should the governments of, for example, Canada and the United States specifically so agree, VHF or UHF digital communications across national borders shall be permitted." The Commission recognizes the potential desirability of such intercommunication and accordingly the final rules have been fashioned in such a way as to not preclude the use of unspecified digital codes across borders of consenting countries.

5. Several commenters express concern that the proposed rules allowing the Engineers-in-Charge (EICs) of field facilities to restrict the use of unspecified digital codes, or require maintenance of a record of the communications, might be imposed indiscriminately or without due consideration of the burden involved. The comments of the ARRL state, "While the need for this available sanction is manifest ... the practicality of compliance with such a sanction is of some concern. Conversion of a digitized image or voice transmission or the contents of a computer memory into plain language may be difficult to accomplish." The ARRL also expresses concern that "... the potential requirement that an amateur maintain a record ... of all coded transmissions from the station with which communication is established may be burdensome in certain cases." John A. Carroll's comments state that "... high speed digital communication could rapidly generate a large amount of communicated information, which, by Amateur standards, would be prohibitively costly to file." His comments also state that "(t)his is not to suggest that the provision shouldn't be there; (it would be) an important contribution to effective enforcement intended to be used."

6. The Commission is sympathetic to these concerns and we are including language in the final rules which states that the authority being granted to the EICs to limit unspecified coding, or require maintenance of a record, may only be invoked when "... necessary ... to assure compliance with the rules...." We are also deleting from the final rules the proposal that the EICs be authorized to require the recording of communications from a station with which communications are established using unspecified digital codes.

FILE QST.82.09.26.0.KD2S

Paul,

Thanks for your willingness to publish the TAPR report. I won't be able to reload same until tonight. If that fits in with your schedule, fine. Otherwise, I'll understand. We've begun a new effort here to finish both the hardware and software "on schedule", but the work loads of the group have been uncompromising in the last many weeks. Lyle is writing assembler interrupts for the 6809, while Margaret and several of us are going to be writing all aspects of the TAPR protocol in Pascal, and offering each level as we finish them to all interested parties, in hopes they will try other protocols and interface ideas. (Talk to Dave and Terry... will they write the AX.25 protocol directly onto a 6809 TNC? Gordon has already promised to write the AX.25 interface code to sit on the top of the TAPR protocol.)

I'll bring all hardware and software developed to date with me when Lyle and I see at the AMSAT meetings. I'll drop off a copy of either the alpha or 6809/alpha boards when I see you there.

Please look for more here tonight.

73, Den

FILE QST.82.10.12.0.KA6M

To: All Packet Stations
From: Hank Magnuski, KA6M
Date: 12 October 1892

Special to AMSAT Satellite Report -- de Hank Magnuski, KA6M

NATIONAL AGREEMENT ON PACKET RADIO STANDARDS!

As part of the October 10th, 1982 AMSAT (Amateur Satellite Corp.) general meeting, president Tom Clark, W3IWI, invited a number of leaders of active packet radio groups to come to a special working committee meeting on Friday, October 8th, to discuss the future development of AMICON, the AMSAT International Computer Network, and a new project tentatively called PACSAT I, a low-altitude orbit, all digital store-and-forward transponder. To Tom's great surprise, a number of people showed up, representing these groups: New Jersey - Phil Karn, KA9Q; Tuscon Area Packet Radio (TAPR) - Den Connors, KD2S and Lyle Johnson, WA7GXD; St. Louis Area Packet Radio (SLAPR) - Pete Eaton, WB9FLW; AMRAD (a big WAPR) - Paul Rinaldo, W4RI, Dave Borden, K8MMO, Terry Fox, WB4JFI, Bob Carpenter, W3OTC, and Eric Scace, K3NA; the Pacific Packet Radio Society - Hank Magnuski, KA6M; AMSAT - Tom Clark, W3IWI, and Jan King, W3GEY.

Even more surprising is that this diverse group managed to agree on somethings. In fact, the agreement reached on adopting a common link level protocol may prove to be extremely significant in forming the foundation for U.S. packet radio networking. The meeting which originally was supposed to iron out some AMICON details managed to have much more of an impact. Here's some background on what happened:

A year ago, in conjunction with the '81 AMSAT general meeting, Paul Rinaldo organized the first Packet Radio Networking Conference which was held at the NBS in Washington (some excellent conference proceedings are still available). Many ideas and some real and paper networks were discussed. In the months which followed quite a few people got their packet radio controllers running and had a chance to experiment, read, discuss and think about various problems involved in implementing PR networking. The situation became discouraging. It seemed like a new protocol was proposed for each TNC that came on the air. Each group started heading off in a different direction. The promise of compatible systems grew remote.

But in this dispersion of effort people also found out how difficult it was to implement private protocols and how difficult the interconnection would be if common ground wasn't found. The different groups also came to realize that there was a common set of problems to be solved and that one area's solution couldn't ignore the requirements of other users. The summer doldrums saw very little activity and not much progress, and provided the background for the AMSAT meeting.

The AMICON Network

Two major areas of concern filled the agenda of the AMICON meeting: the modulation method to be used for the Phase IIIB special service digital channel, and the protocol to be used for linking two ground stations via the satellite.

There was a lot of discussion on the modulation method, and Den Connors and Lyle Johnson of TAPR and Paul Rinaldo of AMRAD presented their research findings. Many different modem types were reviewed and international requirements were discussed. After all the debate the following conclusions were reached:

1. The L1 SSC will be restricted to 5 kHz bandwidth (at the 26 dB points). Modem performance is a primary consideration for a groundstation, and the modem used will probably be of a fairly advanced design.
2. The use of 202 modems using NBFM-AFSK will not work.
3. The use of 202 modems using SSB-FSK will produce marginal results.
4. A 1200 bps channel speed is probably optimal, as this speed satisfies a variety of different constraints and requirements.
5. The BPSK modulation method developed for IIIB telemetry should be explored at both 400 and 1200 bps.

6. The AMRAD and TAPR groups are going to pursue development of a modem which employs Minimum Shift Keying (MSK). MSK is the considered the most promising method at this time.

7. The SSC will have to be open for different experimental approaches until there is general agreement and experimental validation of "the" method.

Considering all the alternatives which were discarded, the above resolutions represent a significant narrowing of focus. If that wasn't enough, more was yet to come!

Eric Scace reviewed the work which had been done by the NJ & AMRAD packeteers to adapt the international X.25 protocol to amateur needs. The amateur subset has been documented by Terry Fox, and is now called AX.25. Hank Magnuski distributed a tutorial document on connectionless protocols and described work which had been done to develop Revision 4 of the TIPM and LIPM software. This is the first implementation of software utilizing amateur calls only for addressing.

By the evening of the 8th the group began to recognize that only minor differences separated the AX.25 and LIPM.04/TIPM.04 approaches. The TAPR protocol users were willing to implement an interface based on the recommendations which would come out of the meeting. The differences were resolved and led to the unanimous adoption of a subset of an internationally recognized link level protocol (specifically, ANSI X3.66 ADCCP-HDLC BA Class, with options 2, 4, 7, 8, & 11).

Why is this important? First, this link level protocol allows two AMICON groundstations to construct a packet pipeline. This same protocol can be used between two stations in a terrestrial backbone net. The same protocol can be used terminal-to-terminal and terminal-to-terminal via a simplex packet repeater. It is a slight extension of the X.25 LAPB link level protocol. Finally, it does not restrict future development of ISO Level 3 virtual circuit or datagram protocols.

The key feature of the new design is the adoption of a scheme for using call-sign addressing in a packet. The packet format looks like this:

```
-----  
] FLAG ] TOCALL ] FMCALL ] CTL ] PID ] INFOFIELD ] FCS ] FLAG ]  
-----
```

where:

FLAG	Standard opening HDLC flag byte (01111110)
TOCALL	The destination call-sign (6 char's plus sub-station ID code)
FMCALL	The source call-sign of (6 characters plus sub-station ID code)
CTL	Standard HDLC control byte
PID	Protocol Identification byte for information frames.
INFO	Information field in information frames
FCS	Frame check sequence
FLAG	Closing flag byte

Frames to be repeated by a local area network simplex packet repeater also contain a third address field following the FMCALL field. This third field is the callsign of the repeater. More details on this protocol will be published in the revised AX.25 document.

Collectively, the group considered nearly every design which starts out with a statement something like this: "Holy 807's, look at all the overhead bytes you have in using call sign addressing. I can do it with just 4 bits." We have found that these other schemes have their own defects and that the penalty for the call sign overhead is relatively small in comparison to other delays on the link and in view of the other benefits.

The AMICON session ended with promises from various members to try to implement the required versions of this new protocol. In the interim, LIPM.04/TIPM.04 will be used by AMICON groundstations until the new software is ready.

PACSAT

Tom Clark described a potential opportunity in the late '84 timeframe for a new low-altitude orbital launch. Tom reviewed various considerations which led to the concept of building a satellite which would be an all digital store-and-forward transponder - a flying mailbox. This satellite would have a computer, two or more digital serial I/O channels, appropriate modems, and 1/2 to 1 megabytes of on-board memory. Messages put in on one side of the earth could be extracted on the other side. The operation would be somewhat like using a CBBS, but only for 15 minutes at a time!

Tom proposed a preliminary design, and there was an extended discussion of the pro's and con's of the project. Various implementation ideas were suggested. Den Connors and Lyle Johnson agreed to put together a more detailed PACSAT proposal for Saturday, and presented it at a seminar on the 9th.

The project concept was presented at the AMSAT general meeting, and since no opposition was raised, further development of the PACSAT proposal is expected.

FILE QST.82.10.15.0.KD2S

Tucson Amateur Packet Radio Activities
by Den Connors KD2S and Lyle Johnson WA7GXD

TAPR is back from a very hot summer, and we're readying for an onslaught of activity in an expanded number of Beta sites. As background, the summer found us switching the processor on our Terminal Node Controller board from a 6502 to the more powerful 6809, to allow for software protocol implementations using concurrent or multi-tasking systems. There are now three different groups working on software, with Lyle WA7GXD building up system primitives in assembler, and constructing a fully-compatible VADCG LIPM04-type protocol. This first effort for hardware testing allows us to use Lyle's Vancouver boards in

both station and repeater modes.

Marc Chamberlin WA7PXW and Dave McClain N7AIG are finishing the FORTH dynamic-addressing experiment. Dave finished the 6809 target compiler for his Apple system, and Marc is rewriting the code he generated on the Point 4 TNC simulator to be compatible, and run on, the Apple. They hope to have this experiment on the air this fall.

Elsewhere in this newsletter you'll find a report on protocol standardization which occurred at the special AMSAT packet radio meeting held in the first week of October. TAPR was represented by Den and Lyle, and was in complete agreement on the resulting "AMSAT standard". To this end, Margaret Morrison KV7D has embarked on an implementation, from scratch, of this protocol. Using 6809 assembler and PASCAL (UCSD standard), Margaret is targeting a fall release. The development system is a combination of DEC-10, VAX running VMS and H.P. 64000 workstations... talk about the classy way to get things done!

We are now working on a target delivery to Beta sites of TNC's next month, but we've learned to keep our mouths shut about promises and due dates. The St. Louis group (SLAPR), ably led by Pete Eaton WB9FLW and Bill Reed WDOETZ, have taken the task and responsibility of having the Beta schematic turned into a layout within the next three weeks, and have also found the mythical "custom transformer" that makes installation of a working TNC no more difficult than opening up the packing box and putting cables back on, installing a radio-dependent plug on the RF interface cable and trying it out. We hope Beta site coordinators will help in the integration of hardware for their areas. Final prices for complete packages will be sent to coordinators very soon; I think we're all in for a very pleasant surprise, due to some dogged arm-twisting by Lyle.

For a little more information on what Lyle and the hardware group have been doing this summer, read on...

The major problem faced in initial experiments with our Alpha TNC's was with the modem radio interface. The TNC ran well at 600baud, but balked at 1200. Plots were made of the audio response of the entire system, and the reduced by the team of Morrison and Morrison (KV7B & D). The result was a FORTRAN program to optimize the design of a switched capacitor active filter using the National MF-10CN filter I.C. After a couple of passes, a successful design was made operational, and was tested with numerous radio combinations (courtesy of WA7GXD, KD2S, KV7B, KV7D and NOADI) with favorable results. A warning though.. beware of attempting to operate a packet station with a transceiver that has appreciable levels of second-harmonic distortion. An initial investigation indicated problems with the ICOM IC-211 and the Kenwood TR-7400A.

The CWID circuitry works well now (see the last issue of the PSR) and the transmitter keying circuitry w/ lockout worked

fine for all radios tested. A 6809 adapter manufactured by MMS, Inc. here in Tucson was successfully interfaced to the TNC, replacing the 6502. This modification allows the Alpha boards (made so long ago) to use the same code being developed for the Beta boards.

Although the Alpha test has given boards that work talking to each other over the air, no test protocol has yet been written to test them in a NETWORK configuration. So the Hardware group is temporarily playing software group as well, coming up with both the TNC interrupt drivers for all of the on-board I.C.'s (less the parallel port, for Alpha), and sufficient assembler code to operate with Lyle's two VADCG boards, one using the AMRAD repeater protocol, and the other acting as another station on the net. This gives us both a good test of all software, and a proper test of compatibility with all of the VADCG boards already out in the field.

Our coordination efforts within TAPR have been horrendous, with close to 180 members in over 25 states and four countries as of this writing. We have been simply inundated with requests for information, and have not only missed some of those requests, but have messed up getting information out to our own members! Although we're doing what we can to keep outsiders informed, I would urge anyone with an interest in what TAPR is doing to become a member for just one year, at \$12. The President's office has just taken over handling requests, complaints etc., and will be very responsive to other people's needs.

73, Den & Lyle

FILE QST.82.10.18.0.W3IWI

QST DE W3IWI

News Release on Packet Radio Activities
de AMSAT 16 October 82

*** Long-haul Packet Test Successful ***

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On 16 October 1982, from 16:45 UT until 17:00 UT, a successful long-haul Packet Radio demonstration QSO took place between Maryland and Texas; the stations involved were Bob Diersing, N5AHD in Corpus Christi and Tom Clark, W3IWI near Washington. The QSO took place on the 10 meter band at 28.300 kHz with both stations running FSK at a 1200 baud rate using HDLC protocol currently accepted as amateur radio standards.

.
This demonstration represents another phase of the AMSAT activities to advance the state-of-the-art in amateur radio communications technology development and the tests were conducted to test the suitability of various existing hardware and protocols under weak-signal and QRM conditions in anticipation of the AMSAT Phase-3B satellite launch in February, 1983, and to help in the planning of future satellite missions including

a possible dedicated packet radio mission a few years from now.

.
The demonstration QSO took place just one week after a landmark meeting held under AMSAT's auspices to establish and coordinate common packet radio protocols. This meeting in the Washington, DC area was attended by representatives of packet radio groups from San Francisco, Tucson, St. Louis, Washington and New Jersey. The meeting succeeded in reconciling minor differences that had evolved between the various groups during their R&D activities. The goal of establishing common protocols was focused on the upcoming satellite launches when it will be possible, for the first time, for the different packet radio groups to reliably inter-connect local networks on a global basis.

.
During the long-haul test, both N5AHD and W3IWI were using special 8085 microprocessor based Terminal Node Controller (TNC) hardware developed in Canada by the Vancouver Area Digital Group (VADG), with software developed in Vancouver, San Francisco and Washington. They both used conventional "202A" FSK modems operating thru 100 watt SSB transceivers. A number of packets were successfully exchanged in both directions and the TNC board's software automatically verified the accuracy of each transmission. The HDLC protocol dictates that if any error is detected, the transmitting station re-tries until an error-free copy is received. In the test QSO, the number of re-tries required never exceeded three. The stations had conducted previous long-haul test experiments through the AMSAT-OSCAR-8 satellite.

.
W3IWI has been involved in a number of previous AMSAT demonstration tests including initial feasibility demonstrations using satellites to locate downed aircraft which led to the international Search-and-Rescue Satellite (SARSAT) program and tests of digital phase-shift keying (PSK) techniques to be employed on the Phase 3 satellite series. N5AHD has developed automated, real time telemetry acquisition techniques for the UoSAT-OSCAR 9 satellite and operates AMSAT's Computer Bulletin Board System (CBBS) which can be accessed at (512)852-8194. Both N5AHD and W3IWI have been frequent contributors of amateur radio software which is available through the AMSAT Software Exchange (ASE). Further information about AMSAT, ASE or AMSAT's CBBS can be obtained by calling the CBBS or by writing:

AMSAT
Box 27
Washington, DC 20044

FILE QST.82.10.21.0.VE7ADE

To All PRNET,

It has just been pointed out to me that my rendition of the VADCG parts order form is very confusing. The 'RS232 parts kit' contains everything required to populate a board, including PROM, RAM, 8250, 8273, connectors, sockets, etc. There is 4k ROM and

2k RAM.

Thus a populated board will cost only \$30 + \$117 = \$147 U.S. in kit form. This includes VE7CVS's version of the LIPTT and TIPTT if you give the defaults needed (callsign, etc.).

The separate listings for individual ICs is for those who need only those parts. Hopefully we did not discourage anyone permanently from getting involved in Packet Radio.

73 es cul
John, VE7ADE

FILE QST.82.10.25.0.KD2S

TO ALL BETA TEST COORDINATORS
FROM DEN KD2S
RE "THE TEST"

I'm sending you a copy of a letter which is being sent to all coordinators this week. We need to know who out there wants to help with the test still. At this time, I only have about 140 known "confirmees", but we need to have those people reconfirm. We have a "drop dead" date of Nov. 7, for we will order the first set of parts the next day. Feel free to use this medium to advise me of any late additions/cancellations up to that time. It's finally upon us!

NOTES:

- 1) The beta boards will be sent with 24K (2764) EPROM and 6K RAM.
- 2) All cables and connectors (except the radio connector) will be shipped.
- 3) The transformer, power cable and fuse/fuse-holder will also be shipped.
- 4) The software that will be on-board will be a VADCG-like protocol written by Lyle WA7GXD for testing operation and compatibility.
- 5) If the software is ready, AX.25 protocol will be available, courtesy of the efforts of Margaret KV7D and Harold NK6K et. al. in LA.
- 6) If the software is ready, TAPR/DA (dynamic addressing) protocol will be available, courtesy of Marc WA7PXW and Dave N7AIG.

Tucson Amateur Packet Radio
October 21, 1982

Dear Beta Coordinator:

We are nearing the time when Beta Test will be in high gear, with TNCs being built, tested, and shipped. We are writing you to let you know our anticipated schedule, and to make our request for firm orders.

At present, the final layout of the Beta board is being done through the efforts of SLAPR, our affiliate in St. Louis.

We expect to receive the layout by November 10. At the same time we intend to make our initial parts orders. Once this is done we are locked into a rigid schedule based on the parts invoicing. Therefore, before we make our parts order (currently anticipated to be November 8) we MUST know the true number of TNCs destined for your site. This means we need a firm order for each TNC. We also need to cover our preliminary costs (board layout will exceed \$1300, for example).

For both these reasons we are requesting a \$50 non-refundable deposit for each TNC. Checks should be made out to Tucson Amateur Packet Radio or TAPR. Alternatively, any participant wishing to pre-pay our current estimated cost of \$200 may do so with the understanding that no additional cost increases will be passed along to him. (We don't anticipate significant increases, but the exact cost will not be known until we have the final count on TNCs ordered.) The cut-off date for orders is November 7, just before our parts order. Please inform your participants of this important information. As you do so, please bear in mind the following facts concerning Beta Test.

First, Beta Test is not a commercial venture. It is, rather, an experiment. For this reason, we ask that each participant ordering TNCs sign the statement below, indicating acceptance of the risks associated with participation in an experimental venture. We cannot adopt a "service what we sell" policy during Beta Test. The Beta Coordinator must ensure that there is an adequate base of technical support locally, to repair and modify the TNCs. This is why we have restricted the test distribution to sites indicating they have the local expertise to handle problems. Beta sites with fewer than four or five members may find it impossible to build a self-supporting group, and would be well advised to find more local support before getting further involved.

On the other hand, we will do everything in our power to ensure shipment of functioning TNCs. We take great pride in our work, and intend to have the fewest possible problems during Beta Test. It is our policy that we will give you, the Beta Coordinator, as much support as possible. If you run into a problem you can't handle without our help, please call us or one of the other people in the local group. But bear in mind that for us and for the rest of the group involved in getting Beta Test out the door, packet radio must remain a hobby, taking second place to making a living (sigh).

Here is the schedule we anticipate. Please note that the dates are approximate. If problems arise at some point the result will be some slippage.

7 Nov	Receive layout	Order parts	]
	]	]	]
10 Nov	Correct & return	Drill mask	]
	]	]	]

15 Nov	Receive layout	]	]	]
		]	]	]
25 Nov		]	Receive parts	]
	]	]		]
29 Nov	Fabricate boards	]		]
	]	]		]
7 Dec	Stuff boards	Burn proms	Make cables	]
	]	]		]
9 Dec	Integrate boards		Write documentation	]
	]			]
	Test & repair			]
	]			]
	]	]		]
14 Dec	Pack boxes (final payment due)			]
	]			]
20 Dec	Ship			]

Assuming parts are ordered according to this schedule, the vendors will need to be paid no later than December 15. Therefore, your participants should plan on completing payment prior to this date.

Thanks very much for your interest and assistance. Your efforts will help to make packet radio the success so many have believed it to be capable of.

73,
Den KD2S and Dan KV7B

FILE QST.82.10.25.0.W3IWI

Hank,

tnx for reply on the document. Den and I have re-written the PACSAT section and I'll forward it to y'all vy soon. N5AHD and I ran a total of nearly 3 hours of pavkets on 10m this weekend, with K8MM0 acting as SWL. Dave plans to be ready to xmit by next weekend. I think that the 10m tests are relevant to the AMICON planning 'cuz we are working on a fading and QRM-filled channel. Still it wrkd well except the blankety-blank M03 software seems to keep eating pointers or stack or sumthin'. After abt 10-20 minutes, things disconnect themselves and TNC goes into a state of catatonia. Has anyone ever found what the problem is? I'm sure it's happened to others and that the Washington area ROM clones aren't unique.

73,tom

TO: Tom, W3IWI
FM: Hank, KA6M

Glad to hear you're having such good luck on ten. I wouldn't have expected it. That band used to be my favorite in high school, and brings back many memories. I have no HF equipment at the moment, unfortunately.

I know of only one error situation in the TIP03 software which could cause a major crash. If the input data overruns the buffer in disconnected mode, there is not a failsafe interlock on the buffer ring pointers. Usually this can only happen if one of the TNC's is connected to a computer, which can generate lotsa lines in no time. A typical scenario is that the computer is sending out a long file, and the transmit buffer is full, and then a problem on the link causes the boards to disconnect after 32 retries on the channel. The TIP goes into disconnected mode, the computer is given a Control-Q, and a wrap-around occurs which is not provided for in the code. You can eliminate this problem by having the TIP discard any lines of text it receives if it is not connected. I didn't see any easy way to throttle back the host in disconnected state.

I've also seen VADCG's go crazy if they are not properly shielded. Very strange stuff can happen if RF gets into the board. Any VADCG that is not mounted in a metal box with RF filtering is suspect.

Hope that might help you resolve the problem. Keep up the good work.

73, Hank

Hank,

Depends on your definition of life, to be sure, no actually I guess we could blame it on the summer doldrums too. You should be getting a newsletter shortly and the next thing on our list is the annual Personal Computing Fair where we will be giving the usual demonstrations and talks.

Plans include getting on 20m with the Collins crystal controlled rig, putting a TNC on a local multiport BBS and an RTTY gateway. After that there will be the satellites to consider. We are still hoping to see a station node developed, as well as a broad band dedicated radio design.

Stuff is still selling steadily, although we must have over 6 months inventory of some parts at the current rate. We've sold nearly fifty of the TNC parts kits and another fifty plus of the modems. How many TNCs have you had made up from the artwork Don sent you? We still have about 150 left from our last order. Wouldn't mind moving them out before 2708s become completely passe.

Now that there is some agreement on the standardization of the protocol we should get the various TT versions rationalized so that bugs common to all have been removed and if there is any reason to have more than one that they all have a full set of features. Is any further work being done on the .04 TT software? VE7CVS's revision is supposed to go in the mail this week. Enough for now.

73 es cul
John, VE7ADE

FILE QST.82.10.27.0.N6FQR

To: All Packeteers
From: Bill Danielson and Ron Brown

Here are the errors/changes that Ron and I made to get our VADCG modem boards operational:

In the instructions, the pictorial of the PC board contained the following errors:

1. The jumper wire above C11 is not shown.
2. The locations of the resistors R27 and R19 is reversed.

The values of the resistors R15 and R17 are reversed. R15 should be a 33K resistor and R17 should be a 16K resistor. In my schematic, R15 is the resistor connected to pin 7 of U3 and R17 is connected to pin 8 of U3. This error causes the two modem frequencies to be reversed.

The 1uF capacitor C4 is not listed in the parts list.

In addition, I made the following modification:

The board contains a CMOS switch (4053) to automatically switch the transmitter input between the modem and a PTT microphone. It also can use the receiver's sequelch output as a transmit disable. I did not want either of these features so I disabled them and used the parts on the board for a CTS indicator. To do this:

1. Remove D2, D3, and D7.
2. If you cannot find a 4053, you can replace it with a header with pins 13 and 14 connected since it no longer needed as a switch.
3. Connect the "sequelch in" line to the "CTS" output line. This can be done either on or off the board.

PIN 3, the Sequelch LED driver output, is now the CTS LED driver output!

Misc comments:

After tuning the modem as described in the instructions, you can check it out by temporarily connecting pin 7 (audio out to xmitter) to pin 12 (audio in). \Make sure nothing else is still connected to these pins!} This puts the modem into what's known in the modem trade as analog loopback mode. Adjust the output level using R20 until the carrier detect lamp comes on. Now if you toggle the TXD input between +12 and ground, you should see

the TXD and RXD leds track each other (Both should be on or off at the same time!). The carrier detect lamp stay on continuously.

To make a quick test of the RTS delay circuitry, you can toggle the RTS line between 12V and ground and watch the RTS and CTS indicator LEDs. You should see a short delay between RTS becoming TRUE and CTS becoming TRUE. To test the send hang timeout circuitry, leave RTS TRUE for a long period (over 1 minute) and you should see CTS go false after 30 seconds to a minute.

Good luck,

Bill N6FQR
Ron WA6JFZ

FILE QST.82.10.29.0.W3IWI

To all packeteers de W3IWI, KD2S, KA6M:

The files listed below contain the edited outputs from the Packet Radio Meeting held by AMSAT earlier in October. Hope they are of use.

Special to AMSAT Satellite Report
de Hank Magnuski, KA6M 12 October 82
(minor editorial revisions de W3IWI)

AGREEMENT ON PACKET RADIO STANDARDS!

As part of the October 10th, 1982 AMSAT (Radio Amateur Satellite Corp.) general meeting, president Tom Clark, W3IWI, invited a number of leaders of active packet radio groups to come to a special working group meeting on Friday, October 8th, to discuss the future developments in packet radio activities; specifically, this meeting was intended to discuss AMICON (the AMSAT International Computer Network) for the Phase-3B spacecraft and to discuss a new project (tentatively called PACSAT) involving a low-altitude orbit, all digital store-and-forward transponder. To Tom's pleasure and surprise, the meeting was well supported and a number of people showed up, representing these groups:

New Jersey - Phil Karn, KA9Q;

Tucson Area Packet Radio (TAPR) - Den Connors, KD2S and Lyle Johnson, WA7GXD;

St. Louis Area Packet Radio (SLAPR) - Pete Eaton, WB9FLW;

Washington (AMRAD) - Paul Rinaldo, W4RI, Dave Borden, K8MMO, Terry Fox, WB4JFI and Eric Scace, K3NA;

Pacific Packet Radio Society (PPRS) - Hank Magnuski, KA6M;

AMSAT - Tom Clark, W3IWI, Jan King, W3GEY, John DuBois, W1HDX
and Bob Carpenter, W3OTC.

Even more surprising is that this diverse group managed to agree on some things. In fact, the agreement reached on adopting a common link level protocol may prove to be extremely significant in forming the foundation for U.S. packet radio networking. The meeting which originally was supposed to iron out some AMICON details managed to have much more of an impact. Here's some background on what happened:

A year ago, in conjunction with the '81 AMSAT general meeting, Paul Rinaldo organized the first Packet Radio Networking Conference under the sponsorship of AMRAD, ARRL and AMSAT in Washington (some excellent conference proceedings are still available). Many ideas and some real and paper networks were discussed. In the months which followed quite a few people got their packet radio controllers running and had a chance to experiment, read, discuss and think about various problems involved in implementing packet radio networks. The situation became discouraging. It seemed like a new protocol was proposed for each new set of Terminal Node Controller (TNC) hardware that came on the air. Each group started heading off in a somewhat different direction. The promise of compatible systems was growing remote. But in this dispersion of effort, people also found out how difficult it was to implement private protocols and how difficult the interconnection would be if common ground wasn't found soon. The different groups also came to realize that there were a common set of problems to be solved and that one area's solution couldn't ignore the requirements of other users. The summer doldrums saw very little activity and not much progress, and provided the background for the AMSAT meeting. This inevitable diversity during the R&D phases for each of the groups had to be reconciled with the impending launch of the Phase-3B satellite in February, 1983.

The AMICON Network

Three major areas of concern filled the agenda of the AMICON meeting: the usage of the Special Service Channel (SSC) earmarked for digital experimentation and called "AMICON" in AMSAT planning documents; the recommended modulation methods and bit rates to be used on the Phase-3B SSC; and the detailed link protocol to be used for linking ground stations via the satellite.

There was general agreement that standards accepted today must be regarded as developmental. It is too premature to ordain any single scheme at this time. The AMICON concept is not yet a detailed network design, but rather an opportunity to develop a new service for amateur radio. In the developmental phases we may well see many diverse techniques being tested. The meeting discussed the concept that the use of high-altitude

satellites for packet radio would be sufficiently complex that it was unlikely that many individual users would be able to muster the resources for individual access. Rather, AMICON would probably evolve as a channel for linking local "concentrator" nodes around the world.

There was a lot of discussion on suitable modulation methods and bit rates that could be supported by Phase-3B. Den Connors and Lyle Johnson of TAPR, Paul Rinaldo of AMRAD, and Tom Clark and John DuBois of AMSAT presented their research findings. Many different modem types were reviewed and international requirements were discussed. After all the debate the following conclusions were reached:

1. The AMICON SSC usage should be restricted to 5 kHz bandwidth (at the -26 dB points). Modem performance must be a primary consideration for any ground station, and the modem used will probably be of a rather advanced design.

2. The use of 202-type modems using NBFM-AFSK will not work.

3. The use of 202 modems using SSB-FSK will produce marginal results.

4. A 400-1200 bps channel speed is probably optimal, as this speed satisfies a variety of different constraints and requirements.

5. The PSK modulation techniques developed for Phase-3B telemetry should be explored at both 400 and 1200 bps.

6. The AMRAD and TAPR groups are going to pursue development of a modem which employs Minimum Shift Keying (MSK). MSK and PSK are considered the most promising methods at this time.

7. The SSC will have to be open for different experimental approaches until there is general agreement and experimental validation of "the" optimum method.

Considering all the alternatives which were discarded, the above resolutions represent a significant narrowing of focus. If that wasn't enough, more was yet to come!

Eric Scace reviewed the work which had been done by the NJ & AMRAD packeteers to adapt the international X.25 protocol to amateur needs. The amateur subset has been documented by Terry Fox, and is now called AX.25. Hank Magnuski distributed a tutorial document on connectionless protocols and described work which had been done to develop Revision 4 of the TIPM and LIPM software. This is the first implementation of TNC software utilizing only amateur calls (and not hard-wired assigned addresses) for addressing.

By the evening of the October 8, the group began to recognize that only very minor differences separated the AX.25

and LIPM.04/TIPM.04 approaches. The TAPR protocol users were willing to implement an interface based on the recommendations which would come out of the meeting. The differences were resolved and led to the unanimous adoption of a subset of an internationally recognized link level protocol (specifically it is called ANSI X3.66 ADCCP-HDLC BA Class, with options 2, 4, 7, 8, & 11).

Why is this important? First, this link level protocol allows two AMICON ground stations to construct a packet pipeline. This same protocol can be used between two stations in a terrestrial backbone net. The same protocol can also be used for terminal-to-terminal connections, whether direct or via a simplex packet repeater. It represents only a slight extension of the CCITT X.25 LAPB link level protocol. And finally, it does not restrict future development of ISO Level 3 virtual circuit or datagram protocols.

The key feature of the new design is the adoption of a scheme for using call-sign addressing in a packet. The packet format looks like this:

```
-----  
] FLAG1 ] TOCALL ] FMCALL ] CTL ] PID ] INFOFIELD ] FCS ] FLAG2 ]  
-----
```

where:

FLAG1 Standard opening HDLC flag byte (01111110)
TOCALL The destination call-sign (6 char's plus sub-station ID code)
FMCALL The source call-sign (6 char's plus sub-station ID code)
CTL Standard HDLC control byte
PID Protocol Identification byte for information frames.
INFO Information field in information frames
FCS Frame CRC check sequence
FLAG2 Standard closing HDLC flag byte

Frames to be repeated by a local area network simplex packet repeater also contain a third address field following the FMCALL field. This third field is the callsign of the repeater. More details on this protocol will be published in the revised AX.25 specification document by WB4JFI et al.

Collectively, the group considered that nearly every link design starts out with a statement something like this: "Holy 807's, look at all the overhead bytes you have in using call signs as addresses. I can do it with just 4 bits." We have found that these other schemes have their own defects and that the penalty for the call sign overhead is relatively small in comparison to other delays on the link and in view of the other benefits. In addition, both amateurs and their regulatory authorities are particularly defensive that the individual's call sign is sacrosanct and tantamount to being a personal name.

The AMICON session ended with promises from various representatives to try to implement the required versions of this new protocol. In the interim, LIPM.04/TIPM.04 will be available for use by AMICON ground stations until the new software is ready.

PACSAT

The other main topic of the meeting concerned the possibility of a dedicated packet radio satellite. This is discussed in a companion news release from KD2S and W3IWI 'see below^'.

PACSAT -- A New AMSAT Satellite Project

Den Connors, KD2S and Tom Clark, W3IWI

A new type of amateur satellite was proposed by Tom Clark, W3IWI, at the packet radio working group meetings held 8-11 October, 1982 at the AMSAT laboratory in conjunction with AMSAT's annual general meeting. The working group meeting was also noteworthy in that it provided a focus for the various packet radio groups to coordinate their activities and resulted in a new unified protocol which is described by Hank Magnuski, KA6M, in a companion document. The new satellite project has been tentatively dubbed PACSAT -- a final name is yet to be chosen, pending resolution of some potential copyright conflicts. This satellite would build upon AMSAT's experience in low-cost spacecraft development, the current upsurge of interest in digital and computer techniques, and the technology being developed for amateur packet radio applications. The basic idea is to implement an orbiting digital packet radio repeater with store-and-forward capabilities. This satellite would allow amateur "electronic mail" service with a few hour delivery time to anywhere in the world -- a virtual "flying mailbox" for amateur radio and computer enthusiasts.

The "strawman" system proposed by Tom and discussed during the three days of meetings, would have one or more high-speed packet radio channels, and possibly other ASCII or RTTY input/output channels. An onboard computer system would control a large amount of memory storage -- perhaps as much as one megabyte for messages. Access to the message system would be somewhat like using a more traditional computer bulletin board system (CBBS) using landline dial-up capability. Using a Phase-2 type of low-earth orbit ("LEO"), the satellite would be available several times a day for up to 15 minutes worth of message reading and writing. Although the LEO satellites are limited in their coverage, the store-and-forward capability could extend an AMSAT-OSCAR-8 type satellite to provide global coverage.

One of the major problems with such a concept is that packet radio represented new technology to most amateurs, although we see a marked rise in amateur interest in computers. In order to make a PACSAT be a viable concept, the current packet radio "experts" will have to devote considerable efforts to making reliable ground-station hardware and software available to AMSAT's user community, and they will have to embark on a concentrated educational program to explain these new concepts -- some of the attendees at the working group meeting noted that they were around when the SSB vs. AM "wars" were raging in the early 1950's.

One of the major technical problems that will have to be solved before a PACSAT (or the AMICON channel for Phase-3B) is viable involves modems. None of the standard commercial modems seem suitable for noisy channels with doppler shift. Several alternatives were discussed during the meetings. The modulation techniques mentioned included phase-shift keying (PSK) and minimum-shift keying (MSK). Discussions of data rates for up- and down-links ranged from 400 baud up to 56 kbaud; the technical constraints associated with acceptable bit error rates and practical constraints of implementation cost and difficulty plus available spectrum space led to a consensus that likely rates were in the 400-2400 baud range. Although the Phase-3B telecommand group have implemented state-of-the-art 400 baud PSK modems and W4RI has been working on MSK designs, the use of either technique will require considerable work in order to develop high reliability modems usable by the amateur community. For any digital usage of amateur satellites, it is clear that modems will be more complicated than the traditional frequency-shift keyed systems currently used for RTTY.

The strawman design Tom presented involved multiple uplinks and a single downlink (e.g., one calling uplink channel and perhaps four working channels). This built upon typical amateur net experience with the satellite acting as "NCS" on a calling-and-answering frequency. After the user calls in and establishes that he has uplink traffic (or that the satellite has a message for him), he would be directed to QSY to a working message channel where the spacecraft's computer would "poll" the user until both he and the spacecraft are QRU. This design is based on the use of ALOHA-type protocols where the multiple users cannot hear each other, leading to possible "collisions" on the uplink channels; this, combined with Tom's assumption that "what goes up must come down" (i.e. the total message traffic up and down are about equal), led to the multiple uplink, single downlink proposal. Tom's proposal was that the uplink and downlink were full duplex (simultaneous transmission and reception) involving two bands (probably 435 Mhz uplink and 145 MHz downlink). The design assumed that 0.5-1.0 Megabyte of storage was available onboard which could be treated as a "virtual disk" for planning. All messages would be "bit-regenerated" (i.e. no "direct" channel exists between the users except through the satellite), and control of the

communications would be by an active, onboard computer. Other functions to be performed by this computer would include the access mechanism to manage the "virtual disk" storage, handling of the protocols to allow multiple users to get their messages up and down during a single pass, and possibly interspersing of "QST" bulletins in the downlink data stream during moments of inactivity.

On Saturday, the AMSAT members attending the technical forum were allowed to hear packet radio in action on AMSAT's W3ZM (146.235/.835) repeater. W3IWI brought a microprocessor-based Terminal Node Controller (TNC) developed by the Vancouver Area Digital Group (VADG), a "202A-type" AFSK modem, and a standard 2m FM transceiver. Some 50 miles away in Sterling Park, VA, Dave Borden (K8MMO) had his Z-80 CP/M computer hooked to a similar TNC and modem. Amidst normal talk-in activities, the two packet radio terminals were sending brief data packets through the repeater so that those attending the meeting saw a game of "ADVENTURE" being played in the squelch tails. This impressive demonstration was the first exposure for many AMSAT members of the capabilities of digital techniques in amateur radio.

As the weekend proceeded, a number of informal discussions on packet radio continued. Among the experts there grew a general agreement on the data link protocol, with the AMSAT AMICON ADDCP-HDLC definition emerging as being the best for the "LEO" PACSAT too. Arguments for and against Tom's proposal for multiple uplinks (supporting a single downlink) centered on the estimated relative traffic loading on satellite uplink and downlink. These discussions included the observations:

- CBBS experience shows that users "browse" through stored information much more than generating new information. If the PACSAT is to be operated as a flying CBBS, then the design should be reconsidered.

- The "QST" bulletin transmissions will be a very important PACSAT function for the users.

On Sunday, a proposal was made by Den Connors and Lyle Johnson which included a number of the above concepts. Different mechanisms for access using full-duplex uplink/downlink pairs were presented. The AMSAT AMICON (AMRAD AX.25) HDLC logical link protocol was discussed in as a PACSAT standard and a number of network-related issues, including message classifications and buffer allocation/deallocation mechanisms were raised. Lyle presented another possible system block diagram, showing different input/output channels, including command, multiple CPU's and different memories for program store, file directories, buffers and message mass storage. The tasks of the CPU were further detailed, and the different algorithms needed were identified.

During this discussion, Tom Clark outlined the possibility of a truly international implementation strategy. Tom described one scenario with the system design and user education/interfacing being the prime U.S. responsibility, on-board hardware constructed in South Africa, satellite integration performed in the United Kingdom and actual launch handled by the commercial group in Texas which has recently flown a successful test mission (see A.S.R. #41, September 13, 1982). A part of the discussion involved the possibility that part of the US role might also include a new role for AMSAT in being responsible for the distribution of the hardware unique to packet radio unless commercial interest is seen soon; this could serve as a method for generating much needed revenues to support all of AMSAT's activities. To help get this activity moving, Den Connors agreed to act as interim PACSAT coordinator.

The general PACSAT concept was presented at the AMSAT general meeting, and the AMSAT membership welcomed the idea, with the only caveats being expressed as "Can we afford it? Are we stretching ourselves too thin?" Tom indicated that these were AMSAT management concerns too but that the key individuals were very enthusiastic about the concept. He stated that without a dedicated "hardcore" of technical volunteers, AMSAT loses its vitality. Since no further opposition was raised, Tom indicated that further development of the PACSAT concept can be expected.

Since the meetings at Goddard, Den has accepted the position of Project Manager for the US part of the PACSAT project, and several developmental efforts are in the formative stages. ZS1FE has confirmed the South African interest in pursuing the project, and G3YJO has begun "selling" the rest of the payload (which may well be called UoSAT-2). Key developments in the next few months will include ground station design, technology investigations to identify large flyable memories and modem (both MSK and PSK) design, planning for maximum utilization of the Phase-3B designs, conceptual designs of the on-board communications and processing hardware and software and coordination of the roles between the various groups that can contribute to this project.

It is hoped that this satellite will not only give the packet radio experimenters a much-awaited international linking capability, but also provide a new, challenging and unique outlet to the many thousands of new hams who are quite savvy in computer techniques and utilization. The AMSAT team solicits your indications of interest and assistance. This, as with all AMSAT projects, is a volunteer effort -- can we serve as a focus for your creative ideas?

FILE QST.82.11.08.0.WB6RFW

BILL:

HERE ARE A FEW THINGS YOU MAY FIND INTERESTING THAT I GOT FROM SKIP YMH'S BBS.

MSG # 7, 11/16/81 FROM SCOTT W3VS

TO ALL 'HAMNET'

FOR ANY OF YOU WHO MAY HAVE ACCESS TO COMPUSERVE, I WOULD LIKE TO SUGGEST THAT YOU CHECKOUT OUR SPECIAL INTEREST GROUP 'HAMNET'. WE ARE JUST GETTING ROLLING AND ARE SETTING UP SECTIONS FOR PACKET RADIO, AMSAT, ARRL, ETC. TO GET TO US, SELECT THE PERSONAL COMPUTING AREA (MICRONET) FROM THE MAIN MENU. THEN SELECT SIGS. WE ARE LISTED AS A GENERAL INTEREST SIG. HOPE YOU CAN JOIN US. WE WOULD LIKE TO HELP GET THE PACKET RADIO BALL ROLLING BY HELPING TO SERVE AS A CENTRAL CLEARING HOUSE OF INFO. LET US HELP SAVE US ALL SOME LONG DISTANCE CHARGES! - SCOTT W3VS HAMNET SYSOP

FILE QST.82.11.09.0.KD2S

TO all groups

FROM Den KD2S

I'd like to thank very much all the packet groups who have helped both directly and indirectly with our latest efforts at bringing out the next generation of stand-alone terminal node controllers here in the U.S.

Though the efforts of a lot of different TAPR sites as well as Tucson, I'm proud to announce the official start of Beta test, with 19 sites and 180 TNC boards involved. We will be happy to keep all groups updated with our activities, and I'll keep project updates on PRNET.

Our boards should be delivered, fully assembled and tested, with 24K EPROM and 6K ROM on-board, and with all connectors, etc., before the year is out. The first protocol will look remarkably like the new AMSAT/AMICON protocol, and I hope to hear from all the other sites on PRNET next year on phase IIIB.

I'll send a release on the next stage for beta coordinators, as well as a breakdown on individual sites in a message tomorrow.

73, Den KD2S

FILE QST.82.11.12.0.KD2S

TAPR Activities by Den Connors KD2S

The TAPR terminal node controller beta test is finally upon us! We have ordered the parts for the PC boards, and Lyle WA7GXD has populated one of the check boards, tested all of the required hardware and is ready to give the go-ahead for the 180 boards needed for beta test. Here's how it happened...

Pete Eaton WB9FLW and Bill Reed WD0ETZ had been tapping the resources of St. Louis looking for a good P.C. layout facility and a group that could make our custom transformer. They were very successful with both tasks. The P.C. layout was sent to us in the first week of November, and after a careful look-see by Lyle, was modified and approved. The "final" layout arrived that weekend, and has again been checked. As the layout was shipped, Pete and Tom Brickey WB0WRK hid in a P.C. fabrication shop for a period of time, and out popped three extremely good looking "check boards", which are now in our hands here in Tucson. Also sitting down here is a copy of our transformer, with windings for +/- 12 volts as well as goodly quantity of +5 volts, after regulation. Lyle has put a board together, and he and Mark Baker will assemble a second unit later.

The final controller ended up being everything we've been promising, and quite a bit more. Lyle has included 24K of 2764 EPROM and 6K RAM on all boards going to test sites. The on-board Bell 202 type modem has had added to it a four-pole switched-capacitor audio input filter, and still has the built-in modem calibration circuitry. The off-board power supply circuitry is now entirely on-board, less the transformer and fuse holder. We did go 6809 of course, and kept simultaneous serial and parallel port capability (important for some linking experiments we're working on). The on-board wire-wrap area now has power and ground rails, with all three voltages available. It's quite a hummer. We'll be shipping out the boards with solder masking, special coating over the traces and silk screening for component identification. All cables and connectors will be included, less the non-standard radio connector. We hope to have completed shipping all units to Beta sites before the Christmas holidays, and we're currently on schedule, for a change.

(Please note that we don't sell these things for a living, but for those hams interested, we'll be coordinating efforts for further distribution with all of our beta site coordinators.)

And protocol... That brings up the software activities, which are now as geographically distributed as the hardware effort. As noted elsewhere in this issue, the AMSAT packet meeting held in October brought forth a standard protocol for the AMICON effort. The level 2 (data link layer), protocol chosen is not compatible with the current TAPR dynamic-addressing software being developed by Marc Chamberlin WA7PXW and Dave McClain N7AIG. The TAPR/DA routines are much more efficient at sending short packets, shaving 19 bytes off of the packet header in a repeated message, leaving more milliseconds for other transmissions. No

guarantees as to delivery date will be made for this protocol, but Marc is now using some very sophisticated hardware/software tools that he and Dave have been developing, and information will be forthcoming as available.

TAPR is nonetheless committed in a BIG way to being fully compatible with the AMICON standard, and the complete protocol will be available on our TNC's. A separate software effort was begun following that meeting, with Margaret Morrison KV7D spearheading the Tucson efforts. Margaret and Lyle have created a set of routines to interface the software and hardware of the TNC, and Margaret has recently completed a large part of a sophisticated on-board monitoring and debugging system.

The level 2 protocol routines are being put together now by a group that has already had considerable experience doing the X.25 logical link routines. Harold Price NK6K and Dave Henderson KD4NL were working earlier this year on some asynchronous point-to-point linking experiments using largely the same protocol.

Dave, Harold and Margaret have been working very hard together on the interface between high and low-level routines, and are pushing to complete a good set of routines for the first release of the boards to the Beta sites. A "soft" deadline of Thanksgiving weekend is the current target for the "EPROM burning party" for what we call the TAPR/AMSAT protocol.

The documentation for the software is actually being done at the same time as the routines are being written, and some very nicely worded interim reports have been generated by Harold and Dave. The software on both sides of the LA/Tucson connection has been pretty clean, and should be fairly easy for Pascal programmers to read. Chuck Green N0ADI has once again brought out the text editors and spelling check programs, and has begun the task of integrating all of the software and hardware documentation into the first release of the TNC manual, which obviously has the same deadline as our board shippings.

Our final count for Beta test sites, incidentally, was 19, with several sites having over a dozen operators. These cities are scattered across the country, and a list of them will appear next month, along with information on how to contact the site coordinator. Linking these sites will be an interesting undertaking, and several methods will be tried. In addition to setting up a weekly HF net for all of the sites to discuss current problems and cute ideas, we'll be trying to follow in the footsteps of Tom Clark W3IWI and Bob Diersing N5AHD with 10 meter long-haul links. Mike Parker KT7D and Lyle are working on an L-band non-linear amplifier for use with the AMSAT Phase IIIB satellite, and Lyle and I are doing much of the planning for the new PACSAT packet satellite system. Some special linking experiments are being developed in the New York/New England area, and we'll have more to say about these efforts next month.

TAPR has experienced a strong period of growth, and we're now

well over 200 members. The bi-monthly newsletter, Packet Status Register, is looking good, and will be used as a primary mechanism for updating amateur packet operators with in-depth information on TNC hardware, linking experiments and the latest software releases, as well as continuing newsey articles and an occasional tutorial. For further information, please contact us at P.O. Box 22888, Tucson, AZ. 85734.

73, Den and the TAPR group

FILE QST.82.11.13.0.KD2S

To: all groups

From: KD2S

Re: what's in a name

I've received some comments on the naming of the new protocol to go out on the TAPR beta test boards. To clarify, the target protocol includes the physical control of all devices on board, the AMICON-compatible link-level routines (see Nov 82 QEX) and enough networking to test the routines mentioned. Included is a powerful monitor, a mechanism to modify and debug EPROM code (think about that for a minute) on board, and for coordinators or others interested, a set of EPROM burning routines. In light of the explanation above, I'm recommending to the rest of the group the following definition:

"The TAPR/AMSAT protocol is the implementation of the AMSAT Phase IIIB AMICON link-level protocol on the TAPR terminal node controller."

As mentioned in the QEX article, this protocol may be suitably universal for both local area networking and long-haul linking. Also, note that the FORTH software team here is not dead, but have been very busy doing things more important to them than amateur radio. There should be a release of the TAPR/DA protocol (dynamic addressing) in the near future. The group is working on changing all of the simulation code into PROM'able code, and documentation will follow implementation as it now stands. People interested in FORTH on the TNC should contact me, and I'll discuss their needs, comments etc. with Marc Chamberlin WA7PXW.

FILE QST.82.11.16.0.KA6M

+++++ AMICON LINK LEVEL PROTOCOL NOTES +++++

The protocol which forms the basis for the AMICON Link Level design is a subset of ADCCP-HDLC Level 2 protocol. In this protocol the standard unit of information is the frame:

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-----  
] SYNC ] SYNC ] FLAG ] DC ] SC ] RC ] CNTL ] PID ] TEXT ] FCS1 ]  
-----  
] FCS2 ] FLAG ]
```

where

SYNC	-	preframe synchronization, idle flags or zeroes
FLAG	-	start of frame, bit pattern 01111110
DC	-	destination callsign address field (6 chars + SSID)
SC	-	source callsign address field (6 chars + SSID)
RC	-	repeater callsign address field (optional)
CNTL	-	control byte, indicates type of frame, other info
PID	-	protocol ID byte for frames with text
TEXT	-	optional information field
FCS1	-	first byte of frame check sequence (CRC)
FCS2	-	second byte of frame check sequence
FLAG	-	closing flag

Callsign address fields are constructed in the following manner:

CHAR1 CHAR2 CHAR3 CHAR4 CHAR5 CHAR6 SSID

where each call is left justified in the field, padded with blanks, uppercase if possible, and each CHAR is shifted left so that the LSB is zero, except for the last byte of the address fields, where the LSB is set to one, indicating the end of HDLC extended addressing. The SSID byte is of the form

R 11 SSSS X

where R is the "repeated" bit, set to one only in the optional repeater addressing field when the packet has been repeated. The 11 field is reserved and set to ones. It may be used for control purposes if required by a local area net. The SSSS field is the sub-station code, normally all zeros except for situations where a person has more than one station on the air. The X is normally zero, unless this field is the last of the callsigns, in which case it is set to one, indicating the end of the variable length address field.

Other features used:

bit stuffing	-	provides fully transparent transmission of data
NRZI encode	-	Zeroes cause transition which allows clock recovery
multiframe	-	Up to seven frames permitted in a single transmission

Types of frames:

Unnumbered	-	Used for Link Control & Broadcast
Supervisory	-	Used for window & flow control
Information	-	Used for transmission of text

Unnumbered Frames:

FLAG DC SC RC CNTL PID TEXT FCS1 FCS2 FLAG

DC - Destination Call, target station for this packet
 SC - Source Call, originating station for this packet
 RC - Repeater Call, specifies repeater to be used (if any)
 CNTL - 2FH = Initiates a Connect Request (SABM)
 43H = Initiates a Disconnect Request (DISC)
 63H = Acknowledges a Connect or Disconnect (UA)
 0FH = Disconnected Mode Status Response (DM)
 87H = Frame Reject Status Response (FRMR)
 03H = Broadcast Information Packet (UI)

The Poll/Final (P/F) bit, 10H, is used to force a response from the receiving station. Used here and in other frame types for this function.

PID - Protocol ID for frames containing text (see I-Frames)

TEXT - Text field information, only for broadcast packets

Supervisory Frames:

FLAG DC SC RC CNTL FCS1 FCS2 FLAG

DC etc. - Address fields, as above

CNTL	-	7	6	5	4	3	2	1	0	

		] Nr		]P/F]		0	0	0	1	] Receive Ready

		] Nr		]P/F]		0	1	0	1	] Rcv Not Ready

		] Nr		]P/F]		1	0	0	1	] Reject

Nr = Sequence count of next expected I-frame

P/F = Poll/Final bit

Information Frames:

FLAG DC SC RC CNTL PID TEXT ... TEXT FCS1 FCS2 FLAG

DC etc. - Address fields, as above

CNTL	-	7	6	5	4	3	2	1	0	

		] Nr		]P/F]		Ns		] 0]		I-frame

Nr = Sequence count of next expected I-frame
 P/F = Poll/Final bit
 Ns = Sequence count of this I-frame

PID - Protocol ID, defines contents of TEXT field

xx00yyyy = Reserved, undefined at present
xx01nnnn = Reserved for AX.25 protocol
xx10nnnn = Reserved for AX.25 protocol
11110000 = plain text, no Level 3 protocol
xx11yyyy = Reserved, undefined at present

TEXT - Text field, 256 bytes maximum, ASCII code

Timeouts:

T1 - Receive timeout, 2-3 seconds
T1S - Frame timeout, time for frame of maximum length
Tr - Delay time (random) prior to transmission of first frame
of a sequence, 150 milliseconds to 1.25 seconds

The source reference for questions about this protocol is in the ANSI Standard Document X3.66 describing ADCCP. We use the Balanced Mode of operation, with sub-options 2, 4, 7, 8, and 11.

Hank Magnuski, KA6M
November 15th, 1982

FILE QST.82.12.06.0.WB6KTN

To: ALL NO. CALIF. Packet users
Fr: CSU Chico packet group.
Re: CSU Chico packet repeater.
On: 1-Dec-1982

The CSU Chico packet repeater is now on the air on 146.58 Mhz with the call WD6BPR/RPT. It operates low level from the CSU Chico campus with a home-brew J-pole antenna about 35 ft AGL.

We are using Bell 202 type modems out of the financial terminals Electrovalue Industrial in N.J. was selling. These modems are CCITT V.23 modems instead of BELL 202, however to convert them only requires changing two resistor values. For \$55.00, we could not complain. We are using the modems and power supply from these terminals, and have not even touched the rest of the goodies.

We currently have two nodes and the repeater working, and a third node is under construction. We are using the VADCG TNC boards and various 2m rigs ranging from a Kenwood 2400 to a Yaesu FT-221 with equal success. A RBBS system will soon be online as soon as the software decides to work.

Any questions may be addressed to Jim (WD6BPR) (916)893-0385 or Mike (WB6KTN) (916)345-1966 or on 146.49 MHZ simplex.

Many thanks to Hank for all his help. Without his support

we would still be debugging code.

FILE QST.82.12.15.0.W4RI

To : Hank Magnuski, KA6M
Subject: Release of Packet Conference Call for Papers

On December 14, I met with Dave Sumner, K1ZZ, ARRL General Manager, and obtained his oral approval of ARRL sponsorship of the second packet conference and to release a call for papers.

Below is what I plan to publish in the January AMRAD Newsletter which should go to the printer on December 17. I will also take care of sending it as a news release to amateur magazines and newsletters with national coverage and packet clubs other than the West Coast. You can go ahead with West Coast publicity.

NEWS RELEASE

Second ARRL Packet Conference Call for Papers

The ARRL is sponsoring a second Amateur Radio Computer Networking Conference on March 19, 1983 in San Francisco, CA. The conference will be in cooperation with the 8th West Coast Computer Faire being held March 18-20.

The deadline for camera-ready papers is February 5, 1983. All papers should be mailed to Paul L. Rinaldo, W4RI, 1524 Springvale Avenue, McLean, VA 22101. If you plan to speak, please request an author's guide and advise Paul of the title of your paper immediately. Proceedings for this conference will be separate from those for the Faire which had a deadline of November 30, 1982.

Technical papers are invited on all aspects of amateur packet radio, advanced radioteletype (RTTY) including AMTOR, and related Amateur Radio digital communications via hf, vhf/uhf and satellite media. Topics may include network and system architecture, proposed standards, hardware, software, protocols, modulation and encoding schemes, and applications. This is an excellent opportunity to have your ideas influence the future of amateur digital communications.

This event will be hosted by the Amateur Radio Research and Development Corporation (AMRAD) and the Pacific Packet Radio Society (PPRS). Making up the conference committee are:

Hank Magnuski, KA6M	- Coordination (PPRS)
Stu Neblett, K6VCO	- RTTY & Packet Demos
Bob Reiling, W6JHJ	- Faire Liaison
Paul Rinaldo, W4RI	- Coordination (AMRAD)
	Technical Papers

Curtis Spangler, N6ECT - West Coast Publicity

END OF NEWS RELEASE

73, Paul, W4RI
FILE QST.82.12.28.0.KD2S

by Den Connors, KD2S PACSAT Project Manager

As experiments continue on ground-based packet radio local area networks, a new class of satellite is being considered to handle linking of both individual ground stations and local area networks. The PACKET radio SATellite (PACSAT) system is designed to provide a store-and-forward digital repeater which is available to all groups around the world for fully global network coverage. The satellite provides this coverage by occupying a low-earth orbit (LEO), which has several benefits. The close proximity of passage, relative to geo-synchronous satellite, allows easy access, with good "link margins". There are thousands of amateur radio earth stations that are already configured to operate on this class of satellite. Additionally, proper choice of orbital parameters allows a sun-synchronous orbit, where passage of the satellite occurs at the same times each day, providing an easy means of scheduling transmissions. This orbit then provides both 100% global coverage and very fair access, and creates a powerful new use of a well-known class of amateur satellite.

There are several reasons for providing such a system in the Amateur Satellite Service. PACSAT will be a widely available vehicle for advanced amateur radio experimentation, as well as a prototype system for a new class of satellite service -- reliable transmission of data to remote sites and isolated users, regardless of location. It will also provide a new form of emergency communication -- a reliable, highly available link compatible with global mobile and portable radio service requirements. The PACSAT project will provide AMSAT with a new supply of engineering talent and expertise, fresh sources of funding and new ranks of members.

In addition to the primary use as a world-wide store-and-forward link, or "flying mailbox", the PACSAT experiment will serve a number of other functions. These include real-time regional linking in standard LEO amateur mode and versatile access using more traditional Amateur Radio digital modes. PACSAT will provide extended availability to users via ground stations with linking to local area networks and an opportunity for advanced testing of network systems concepts, hardware software and protocols.

Although time constraints could prevent multiple modes being implemented in the first of the PACSAT systems, it is envisioned that such techniques as Morse code (CW), radio teletype (RTTY), and ASCII using audio frequency-shift

keying modulation would all be possible. The satellite processor could accept such input, store the data in memory and later forward the messages in whatever mode the intended receiver would desire.

PACSAT System Description

The satellite will be an experimental package on one of several possible spacecraft. It would be in a full-earth coverage orbit with 2 to 4 passes per day appearing at the same time each day.

There will be two communications channels, each with multiple input signal capability and individually reconfigurable packet and non-packet modes. The multiple uplink frequencies will use frequency-selectable tracking phase-locked loops. The channels will be full duplex, with a data rate of 1200 bits/second.

The communications channels will use the standard mode B OSCAR configuration (435 MHz uplink, 145 MHz downlink). The satellite will be capable of frequency control of ground stations, and could also direct antenna pointing and predict orbit and pointing coordinates. Except for the modem and controller, hardware for ground stations is already available. The satellite may optionally use an LAN link for large group coverage.

The processor may use the AMSAT-standard 1802 configuration, or possibly high-reliability CMOS microprocessor. There will be a well-defined interface with the spacecraft Internal House-keeping Unit. The main memory may be loaded from ground stations. There are up to 8 megabits of memory possible, using bubble memory or static CMOS. CMOS would be available in 16K or 64K packages. Bubble memory would require a custom MSI-level CMOS controller. Serial input and output to memory modules for data and addressing might be used. Modules not being addressed could be turned off.

Two modes will be available at any time -- synchronous or asynchronous packet, ASCII, RTTY or CW. Packet transmissions could use either phase-shift keying (PSK) or minimum-shift keying (MSK) modulation, or both.

Packet protocol will include a multiple-access common uplink frequency to be used as a "calling channel" and multiple uplink frequencies to be used for working channels.

Transmission collisions will be detected through negative acknowledgement of missed or garbled messages. Frame protocol will use a high-level data-link control (HDLC), a synchronous bit-oriented protocol. Optional frame control sequences are specified in the AMSAT/AMICON Amateur International Computer Network system

specifications (e.g., AX.25 level 2, TAPR/AMSAT). There will be opportunity for various experiments with higher-level protocols. A mailbox protocol with memory management and friendly, efficient user interface will be provided.

The primary use of PACSAT will be for store-on-uplink, forward-on-downlink full-earth coverage. Secondary uses will be for direct (real time) signal regeneration, including bulletin broadcasts, group transmissions, telemetry, and user reconfiguration of the secondary communication mode.

Volunteer Efforts for PACSAT

The PACSAT idea has been mulling around in the heads of several people. This design phase is due to end by mid February, when the need to keep on a two-year deadline will force the design groups to keep working.

Most of the ground station hardware design effort to date has been spread over several groups:

- Tucson Amateur Packet Radio (TAPR)
- Amateur Radio Research and Development Corp.
(AMRAD)
- with further assistance from a strong AMSAT group in New Jersey

Ground-side linking systems are being developed by all of the above groups, as well as with AMSAT groups in New England, the Pacific Packet Radio Society (PPRS) and others.

A number of the above groups are also working on modem technology for the bandwidth-efficient packet channels required. There also exists a group up at the State University of New York at Stony Brook. The possible candidate for best memory technology are being investigated by AMSAT-related organizations in Canada and the U.S.

Problems associated with protocols, spacecraft operating systems, spacecraft-ground communication and ground operating protocols have been looked by almost all of the above groups. There are also groups in Los Angeles, St. Louis and in Lindkoping, Sweden.

Negotiations are underway to set up flight hardware design and fabrication, and groups in the United Kingdom and South Africa might assist in efforts.

(reprinted from the APR Packt Status Registrar #3, December 1982)

FILE QST.82.12.29.0.KD2S

Bibliography on Minimum Shift Keying

The Amateur Radio Service will be undergoing a transformation as personal computers bring the need for high-speed digital communications into the ham shack. The modems now heard on the air will be woefully inadequate to provide bandwidth-efficient data transmission. This has led a number of amateurs to look into synchronous modulation techniques, and in particular, minimum-shift keying (MSK).

MSK was first patented as a "Minimum-Shift Data Communication System" in March of 1961 by Melvin Doelz and Earl Heald of the Collins Radio Company. Known alternately as fast-frequency shift keying (FFSK) in the early literature, the technique provided the minimization of bandwidth the researchers were looking for, using simple frequency-shift keying. The price they paid was in the complexity of the synchronous demodulators.

MSK can be described alternately as frequency shift keying with a fixed modulation index of 0.5, or as phase-shift keying of a digital signal with Gaussian pre-shaping of the signal input to the modulator. This very cryptic non-explanation may be clarified by digging into the available literature.

General Articles -

There are several articles which can give a general overview of the technique. Pasupathy presented MSK in an easy-to-read format for the IEEE in \PAS79}. A more complete technical presentation was done by Rudi De Buda \DEB72}, \DEB74}. Morais and Feher \MOR79} introduce investigations of the effects of noise on MSK, and Gronemeyer and McBride fold in similarities of MSK and PSK in their 1976 article \GRO76}.

\DEB72} R. DeBuda, "Coherent Demodulation of Frequency-Shift Keying with Low Deviation Ratio", IEEE Transactions on Communications, Vol. COM-20, No. 6, pp. 429-35, June 1972

\DEB74} R. DeBuda, "About Optimal Properties of Fast Frequency-Shift Keying", IEEE Transactions on Communications, Vol. COM-22, No. 10, pp. 1726-7, October 1974

\MOR79} D. Morais & K. Feher, "Bandwidth Efficiency and Probability of Error Performance of MSK and Offset QPSK Systems", IEEE Transactions on Communications, Vol. COM-27, No. 12, pp. 1794-1801, December 1979

\GRO76} S. Gronemeyer & A. McBride, "MSK and

Offset QPSK Modulation", IEEE Transactions on Communication, Vol. COM-24, No. 8, August 1976

\PAS79} S. Pasupathy, "Minimum Shift Keying: A Spectrally Efficient Modulation", IEEE Communications Magazine, Vol. 17, No. 4, pp. 14-22, July 1979

Comparisons with Other Techniques -

There are several articles which compare MSK and other modulation techniques, with special emphasis on useable signal-to-noise ratios and required bandwidth. The canonical paper is by John Oetting \OET79}, who compares ALL known modes, and provides a bonus of a extensive bibliography on all of the techniques. Feher and his group have looked at the problem of use on satellites in \LEN82}. A few other pertinent comparisons are included here.

\HIR81} W. Hirt & S. Pasupathy, "Suboptimal Reception of Binary CPSK Signals", IEE PROC., Vol. 128, Pt. F, No. 3, pp. 125-34, June 1981

\LEN82} T. Le-Ngoc, K. Ferer & H. Pham Van, "New Modulation Techniques for Low-Cost Power and Bandwidth Efficient Satellite Earth Stations", IEEE Transactions on Communications, Vol. COM-30, No. 1, January 1982

\MIL81} L. Milstein, D. Shilling & R. Pickholtz, "Comparison of Performance of 16-ary QASK and MSK Over a Frequency Selective Rician Fading Channel", IEEE Transactions on Communications, Vol. COM-29, No. 11, November 1981

\OET79} J. Oetting, "A Comparison of Modulation Techniques for Digital Radio", IEEE Transactions on Communications, Vol. COM-27, No. 12, pp. 1752-62, December 1979

\TEY79} W. Tey & T. Tjhung, "Characteristics of Manchester-Coded FSK", IEEE Transactions on Communications, Vol. COM-27, No. 1, pp. 209-16, January 1979

Filtering -

The utility of MSK has been shown to improve with adequate pre-filtering of the input signal. Morais and Feher \MOR80} give an excellent overview of the effects of filtering and limiting. \BAY79} and \RAB78} discuss bandwidth shaping, and \MUR81} and \SUZ81} explore the use of Gaussian filtering.

\BAY79} J. Bayless & R. Pedersen, "Efficient Pulse Shaping Using MSK or PSK Modulation", IEEE Transactions on Communications, Vol. COM-27, No. 6, June 1979

\MOR80} D. Morais & K. Ferer, "The Effects of Filtering and Limiting on the Performance of QPSK, Offset QPSK, and MSK Systems", IEEE Transactions on Communications, Vol. COM-28, No. 12, December 1980

\MUR81} K. Murota & K. Hirade, "GMSK Modulation for Digital Mobile Radio Telephony", IEEE Transactions on Communications, Vol. COM-29, No. 7, pp. 1044-50, July 1981

\RAB78} M. Rabzel & S. Pasupathy, "Spectral Shaping in Minimum Shift Keying (MSK)-Type Signals", IEEE Transactions on Communication, Vol. COM-26, No. 1, pp. 189-95, January 1978

\SUZ81} H. Suzuki, "Optimum Gaussian Filter for Differential Detection of MSK", IEEE Transactions on Communication, Vol. COM-29, No. 6, June 1981

Implementation -

Although the best implementation discussions are found in proprietary technical manuals of systems built by several corporations, a few articles do describe some details of construction. \AMO78}, \CRU78} and \MAT78} present some practical hardware notes. Masamura et al. \MAS79} show a different technique using differential detection, which needs a higher signal-to-noise ratio to work as well as straight MSK synchronous detection. This differential technique has the benefit of providing error correction, however, and could be used in a number of weak-signal or fading situations.

\AMO77} F. Amoroso & J. Kivett, "Simplified MSK Signalling Technique", IEEE Transactions on Communications, Vol. COM-25, No. 4, pp. 433-41, April 1977

\CRU78} J. Cruz & R. Simpson, "Minimum-Shift-Keying Signal Detection with Noisy Reference Signals", IEEE Transactions on Communications, Vol. COM-26, No. 6, pp. 896-902, June 1978

\MAS79} T. Masamura, S. Samejima, Y. Morihiro & H. Fuketa, "Differential Detection of MSK with Nonredundant Error Correction", IEEE Transactions on Communication, Vol. COM-27, No. 6, pp. 912-18, June 1979

\MAT78} R. Matyas, "Effect of Noisy Phase References on Coherent Detection of FFSK Signals", IEEE Transactions on Communications, Vol. COM-26, No. 6, pp. 807-15, June 1978

\MORI79} Y. Morihito, S. Nakajima & N. Furuya, "A 100 MBit/s Prototype MSK Modem for Satellite Communications", IEEE Transactions on Communications, Vol. COM-27, No. 10, pp. 1512-8, October 1979

This bibliography is by no means complete, and all of the articles mentioned above will lead the reader to more specialized papers.

FILE QST.82.12.29.0.WA7GXD

by Lyle Johnson, WA7GXD

Everything was running on schedule. The Beta parts had all arrived within two or three days of deadline, the assembly facilities were busily stuffing the PC boards. All looked well.

Then a disturbing quality was noted on the PC boards. They weren't taking solder very well. A lot of rework was necessary, and when the rework was being done, the solderability problem got worse. By now it was 7 December, Pearl Harbor Day. It was agreed that the PC house would get us the first boards ASAP (they were all due on the 7th) so we could get rolling with testing.

More delays. More problems. More calls. The solderability of the boards was becoming a major production setback. The chief engineer at the PC fabrication facility was dispatched to one of the two assembly points (both were experiencing the same problems) to attempt to find the cause of, and hopefully a solution to, this problem.

Late Wednesday afternoon a batch of 19 Beta boards were delivered to the anxious checkout crew. Immediately Lyle, WA7GXD, and Pete, WB9FLW, (later joined by Den, KD2S and Dan KV7B) set to work on the boards. Test Number One was to apply power to the boards with no socketed ICs in place to ensure that the voltage regulators were working -- we didn't want to fry \$150 worth of chips! All 19 boards passed with no problems.

The boards were then loaded with ICs along with some calibration/checkout software which was provided by Margaret, KV7D. The first board passed all tests with flying colors. The night passed. By 2:00 AM Thursday, December 9th, we knew we had a severe problem -- only three Beta boards out of fifteen tested were working!

Earlier, in November, Lyle had assembled a sample board provided by SLAPR, and it had worked perfectly. A second test board was hand assembled in November when the first production lot of Beta boards were shipped by the PC production facility. They had tested and calibrated with no problems.

After a brief, fitful rest, a meeting was held via telephone with Den KD2S, Lyle, WA7GXD, and Mark Baker, TAPR secretary and member of the Board of Directors. It was decided to temporarily halt Beta production and meet with the PC house.

This action was taken, and three TAPR executive officers hurried to the PC facility. After much discussion, a PC board was cross-sectioned and examined under a high-power magnifier.

The sight was sickening. A hairline crack encircled each plated-through hole near the pad on the solder-side of the Beta board. Further checks revealed the problem was a plague -- every board checked had the same problem.

This explained the solderability problem: abnormal heat transfer due to a break in thermal conductivity. It also explained the disastrous fallout rate of boards during testing. A few working boards were flexed, and experiments indicated that non-working boards could be made intermittently operational, while working boards could be made non-functional.

The problem was traced to a subcontractor to the PC house who had drilled the boards, and, for reasons of expediency, had also plated through the holes. The local PC house's work was not at fault.

A quick back-of-the-envelope calculation indicated that about \$3600 worth of PC boards, \$1400 worth of labor costs and \$3600 worth of components would have to be scrapped -- a total of \$8600!

TAPR does not have \$8600. The Beta project is a non-profit activity, with perhaps a very few hundred dollars remaining for further R&D. The PC house agreed to immediately produce another set of boards -- at no additional charge -- and TAPR decided to attempt to mount a salvage operation to determine which components could be removed from the 119 boards that had already been soldered. The removed components would be subjected to a statistical sampling and analysis to weed out any potential reliability problems that might result from their use.

As a result, Friday night and all day Saturday various crews were assembled to unstuff, remove, categorize, test and otherwise process the Beta boards. The participants in this heart-breaking task consisted of: Lyle, WA7GXD, Pete,

WB9FLW (who had flown in from St. Louis just to help in the big push to deliver Beta), Den, KD2S, Chuck, NOADI, John, WB7CKY and Dan, KV7B.

The bottom line is that TAPR now has a shortfall of about \$3000 to get the Beta project out. New boards will be ready during the week of 28 December. It is hoped that populated boards will be delivered to TAPR around 10 January, and we hope to ship by the 20th.

We appreciate your patience. We want these boards to be completely reliable. Meanwhile, the software group has more time to debug and enhance the initial Beta programming. A local area network will be established with a few boards that will be nursed along to help in the software effort.

While we are all disturbed by this delay, we are determined to complete development of the Beta boards and get them into the hands of the Packet Radio community as soon as possible. Maximum use of the delay will be made for software enhancement and testing, as well as initial hardware "beta testing". We think you will be very pleased with what you receive in January.

FILE QST.83.01.03.0.KD2S

Dan and Margaret Morrison (KV7B&D) reported this evening that the first of the new run of TAPR TNC boards is now operational. The board was received and assembled by Lyle WA7GXD this afternoon and early evening, and delivered to the University. Dan reports that the installation was by-the-book, and first packets ran perfectly at 1200 baud. More info to follow.

Den KD2S

FILE QST.83.01.07.0.KA6M

To: Whom it may concern
From: Hank Magnuski
Date: January 7th, 1982

Subject: 1983 Packet wish list

The following is a list of projects which have at one time or another been proposed by various people and which, in general, never saw the light of day. Its purpose is not to criticize any particular individual (we are all busy and have work, family and other interests which supercede packet), but to document some of the promise which packet has held which is as yet unfulfilled.

Hopefully, in 1983, we will see some of the items dropped from this list!

1. Promises of other bulletin boards, conference trees, mailboxes, to be established as servers on this network.

The DG remains the one and only.

2. An RTTY gateway or an RTTY mailbox packet port.
3. Better mailbox software and interface for the DG.
4. Network performance analysis writeups.
5. A 20 meter or other HF packet port or gateway.
6. PPRS Bylaws written up.
7. More VADCGs on the air. I have sold TNCs and burned eproms for people who just disappeared into the woodwork. The completion rate of projects is surprisingly small.
8. The regular transfer of ARRL bulletins and HAMNET bulletins to our network.
9. Interface boards for the APPLE, TRS-80, and IBM PC.
10. Linkup to LA. Selection of RF sites and channels.
11. Networking software.
12. Improved DG host port facilities (antenna & software)

On the positive side, these two events are very significant:

National agreement on link level standards.

Development of the TAPR TNC board.

FILE QST.83.01.15.0.W3IWI

From: TCLARK
To: amsat
CC: vrip,vita,dloughmiller
Subj: News Release for AMSAT Nets
FOR IMMEDIATE RELEASE

Jan 14,1983 -- The Radio Amateur Satellite Corp. (AMSAT) and the Volunteers In Technical Assistance (VITA) 'note -- pronounce as VI-TAH as in the word vital^ have today announced their intent to pursue a joint effort to develop a low-cost packet radio satellite system called PACSAT.

VITA, headquartered in Rosslyn, VA, is a private, nonprofit organization that supports people working on technical problems in developing countries with technical information provided by thousands of volunteer scientists, engineers and technologists. The information and assistance VITA provides is aimed at helping local people in developing countries to select and implement technologies appropriate to their local situations.

VITA Director Henry Norman and VITA Project Coordinator Dr. Gary Garriott (WA9FMQ) today announced that VITA has just awarded AMSAT a \$15,000 Design Definition Grant to support development of PACSAT as a reliable low-cost digital satellite system to meet requirements for communications of technical information on renewable energy resources to and from their many field locations. AMSAT's role in this joint activity will be to provide hardware suitable for demonstration programs and to provide technical assistance in developing a low-cost system. Part of this effort will involve adapting solar power, amateur radio and personal computer technology for use in the field, far removed from any technical support.

AMSAT's PACSAT project manager Den Connors (KD2S) indicated that this grant will support initial PACSAT design definition activities which are being coordinated by AMSAT with work being done in some 15 locations around the world.

It is also of interest to note that WA9FMQ is a cousin of NASA astronaut Dr. Owen Garriott, W5LFL who may be amateur radio's first "space mobile" by operating from the Space Shuttle if a proposal submitted by AMSAT and ARRL is approved by NASA.

AMSAT
850 Sligo Ave.
Silver Spring, MD 20910

VITA
1815 North Lynn St.
Rosslyn VA 22209

FILE QST.83.01.22.0.WB9FLW

To all

Current Beta status is a positive one....first production boards were picked up today. The wave soldering went without a hitch and first tests indicate none of the problems faced last month.... One word of warning....the TNC's are RF sensitive, so be on the lookout for a suitable enclosure!

Pete WB9FLW, Tucson AZ 1/22/83

FILE QST.83.01.24.0.SM5HEV

To : All Packeteers

From : Paul Rinaldo, W4RI

Subject: Letter from Jens Zander, SM5HEV

You are sure making progress on standardization. It was with great interest I read first the AMSAT Satellite Report and then the copy of QEX you sent me. The HDLC/AX.25 as proposed there has seemed to gain quite some foothold in the U.S. It will most certainly be incorporated as one of the basic formats in SOFTNET for radio links.

We've also been making some progress, however not on the UHF transceiver. Another redesign! A group in Stockholm has now taken responsibility to make a design of their own. The specs still hold however:

100-kbit/s bit rate
MFM clock coding
FSK/MSK modulation
434-MHz center frequency

The software and computer group has made some more progress. A software specification including a user manual/implementers' guide is almost finished. We are currently testing the network concept using a twisted-pair cable as transmission medium. This has proven to be an excellent "channel simulator" to test our algorithms (cf ULC net presented in BYTE magazine last year). Five nodes using the SOFTNET protocol are in operation with speeds up to 9600 bauds. the 100-kbit/s data rate is at the moment not possible since we have only one prototype of the high-speed hardware. The main (node) CPU of our system is available in kit form including the basic M-FORTH multi-tasking software in two 2732 PROMs. The pc layout of the LINK computer will be made during January.

A few notes on the lowest level (LINK) formats we are using at the present. The packet format is recognized by the first bytes (chars) in the packet, the packet Format Word FW. This is the characters " F " in the case of the basic SOFTNET format F as described below. In the case the first byte should be a HDLC-flag the packet will be recognized as a AX.25 packet and handled that way. A brief (and preliminary) description is enclosed. We will mail you a copy of the full user's manual and Implementors guide as soon as they are printed. Feedback would be appreciated. We would also like to attend the San Francisco conference, at least one of us.

73, Jens Zander, SM5HEV, Linkoping University, S-581 83
Linkoping, Sweden.

(Enclosure)

1. HARDWARE SPECIFICATIONS

Operating frequency	434.000 MHz
Modulation	FSK, frequency shift 50 kHz (MSK)
Bit rate	100 kbit/s
Coding	MFM clock coding

Signalling format:

```
*****
* Preamble * SYN1 * Packet *
*****
```

Preamble: At least 20 transmitted consecutive '1' s
corresponding to 40 zero-crossing on the channel

SYN1 : At least 3 ASCII SYN characters

Packet : Any number of bytes less than 256

Transceiver control and measurements:

Transmitter control: Power controllable in 16 5-dB steps.
Range: -20 dBm -- 55 dBm (4 bits)
Transmit/receive switching (switch time
less than 1 ms)

Receiver output: Slow SNR reading (Channel quality check):
Received (S+N/N) IN 16 3-dB steps.
Time constant | 10 ms (1 packet)
Range: 0 dB -- 45 dB (4 bits)

Fast SNR reading (Channel busy check):
Received (S+N/N) threshold detector (1 bit)
(Tc [50 us). Threshold presetable in
16 steps (4 bits) of 3 dB each.
Range: 0 dB -- 45 dB

Received SNR (S+N/N) measured at data detector.

LINK programming environment

The LINK programming environment consists of a FORTH dictionary with two vocabularies, the LINK vocabulary and the LFORTH vocabulary. When a packet enters the LINK machine interpretation is commenced with the context pointer pointing at the LINK vocabulary. The LINK vocabulary can be said to represent the programming environment for non-privileged users. In this vocabulary only a few words are available. These are listed below. Among them are the so-called format words, which define the access algorithm and the format of the packets used. The standard system has at least to contain the two standard format words 'F' and 'A' described below.

2.1 The LINK vocabulary

```
F ---
A ---
```

Together 'F' and 'A' describe the basic Softnet channel-access algorithm. The following is a description of this algorithm.

Access algorithm:

- Defer : Any node may transmit a packet if
- *Transmissions are not blocked as result of a previous conflict
 - *The channel is sensed to be free for at least 2 ms, corresponding to the duration of an ACK packet plus switching times and path delays.
- ACK : When a node receives a correct (BCS-check) 'F'-packet which contains the address of the receiving node, interpretation of 'F' should result in the immediate transmission of an 'A' acknowledge packet (no channel busy check applies). The ACK should be transmitted with 2 ms after the reception of the 'F'-packet. If an incorrect packet or a packet with erroneous format word is received no acknowledgement should result. Broadcast packets, i.e. packets containing 'wildcard' address fields should not trigger the transmission of acknowledge, even if a match is obtained in the address check procedure.
- Conflict: A node detecting a conflict by mission acknowledgement packets after 2 ms will block its transmissions for a random amount of time. This delay is rectangularly distributed over the interval (0,100 ms). The defer procedure applies also when attempting retransmission. This procedure is repeated the number of times specified by the user (See NODE environment for details).

Packet handling procedure:

'F'-packets

Receive all incoming packets and check the packet BCS (checksum) field. If the checksum is correct, check LDID. If packet has correct destination and does not contain wildcard address fields, issue an A-packet, switch to the NODE environment and start interpretation of the NODE field (below). In case of conflict, retransmit an 'F' packet the number times specified in the NODE environment.

Always check if the LSID (see below) is known to the node. If not, update the NEIGHBOR list (see NODE environment for description).

In case that some known neighbor node does not acknowledge a transmitted 'F' packet after the maximum number of retries, this neighbor is deleted from the NEIGHBOR list.

Packet formats:

The two format words 'F' and 'A' also define a basic packet format as depicted below.


```

*****
* F_ * LDID * LSID * PNR * GSID * BC *   NODE field   * BCS *
*****
0      2      5      8      9      15      16      16+n  18+n

```

```

*****
* A_ * LDID * LSID * PNR *
*****
0      2      5      8      9

```

Comments:

The 'A' packet uses reversed local IDs to simplify acknowledgement procedures, i.e. Local source is the local destination of the 'A'-packet.

BC : Byte count of Node field (n).

BCS : Block check sum, 2 bytes wide of total packet (18+n) bytes.

$$BCS = \left(\frac{\sum_{i=1}^{18+n} W_i}{2^{16}} \right) \bmod 2^{16} \quad W_i = 2 \text{ byte word } i$$

GSID: Global source (origin) of packet. Packet owner ID. 6 globally unique ASCII characters (for instance call sign).

LDID: Local destination of packet (=3 last bytes of global ID)
The destination may contain one or more 'wildcard' characters (ASCII NULL = 00 hex) which matches any character in that position at the receiving node.

LSID: Local source (origin) of packet (= 3 last bytes of global ID) No wildcards are allowed.

NODE: An even number of bytes. This field is interpreted by the 'F' word after selection of the proper NODE environment.

PNR : Packet number, 1 byte. Two consecutive packets transmitted from some node to the same destination have to use distinct packet number.

73, Paul, W4RI

FILE QST.83.01.29.0.N6ECT

Date: January 29, 1983

From: Curtis, N6ECT

To : All Interested Packeteers

Subject: Software Replacement for the SDLC 8273

Just in case that you haven't come across this short article, W4UCH/2, using a TRS-80 Model 1, has created a software 8273. You can find this article on page 53 of the February 1983 issue of QST; titled "PACKET RADIO - A SOFTWARE APPROACH. 73, -CAS-

FILE QST.83.01.30.0.W4RI

To : Den Connors, KD2S/Lyle Johnson, WA7GXD
Hank Magnuski, KA6M

Info : Doug Lockhart, VE7APU
John Spraggs, VE7ADE

Subject: Pre-Frame Sync

Despite outward appearances, I am making progress with the Level 1 document for AX.25 which will include those physical-layer requirements needed for Phase III-B packets. Den saw part of it during his latest trip to Washington. I've run into a slight snag and would appreciate your early inputs.

As you know, HDLC itself, per ISO 3309-1976(E), begins the frame with a flag. Para 3.8 gives only this guidance: "Inter-frame fill shall be accomplished by transmitting either contiguous flags or a minimum of seven contiguous "1" bits or a combination of both. A selection of the inter-frame time fill methods depends on systems requirement."

Also as you are aware, I am working with Bob Watson on the design of a modem which we are now calling "PAM" for Packet Adaptive Modem. It is a multi-speed modem with a constant frequency shift of 600 Hz. The speeds will be 75, 150, 300, 600, and 1200 bauds, remotely selectable via three lines. It started out life as an hf packet modem whose speed could be software controlled to adjust to changing ionospheric circuit conditions. The modulator design is finished. The (MF-10 switched-capacitor) demodulator design is well along, and that portion which operates at speeds up to 600 bauds is complete for optimal demodulation of fading hf packets. When we tested the demod, its performance was slightly degraded at 1200 bauds, owing to the usual problem of filtering out carrier components which are close to the signaling rate. We were planning to leave the hf modem at that then start working on a separate optimal (PSK-type) MSK demodulator, preferably one which is simple and easily reproducible. Then, in the examination of design alternatives, Bob was reluctant to give up the neat MF-10 mark and space filters. So, he is now designing an optimal, synchronous MSK demodulator which is an add-on to the original MF-10 design. So what we'll end up is a modem which is an optimal limiterless type for hf 600-Hz-shift FSK at 75, 150, 300 and 600 bauds and an optimal MSK demod for 1200 bauds. The 1200-baud speed is primarily intended for satellite work but could also be used for terrestrial packets and

hf (particularly on 10 meters when the path is good). I plan to present a paper on this modem at the March 19 packet conference.

So, on to the purpose of this message. In order for a synchronous demod to attain lock, it needs to sample both mark and space frequencies, preferably more than once each. This is true not only for the above-described modem but also for other synchronous modems. A synchronous modem buys us 3 dB, nothing to fritter away for satellite or long-haul terrestrial vhf/uhf packet paths.

Ideally, it would be good to have a pre-frame sync of 2 octets of reversals. Probably not as good, but possibly good enough, would be the transmission of 2 flags before the start of the frame. Unacceptable possibilities (for synchronous modems to work) would be (a) the binary "1" idle (marking) condition or (b) nothing at all.

I checked the Intel 8273 data sheets and found that sixteen line transitions are guaranteed with the chip in the Pre-Frame Sync Mode. Also, I note that this mode is enabled in the Vancouver TIP.

With the information readily available, I was unable to determine whether pre-frame sync (reversals) was possible with the Zilog 8530 or the WD-1933. Terry Fox, WB4JFI made a couple of calls to Zilog and was told that it is possible to produce with liberable amounts of chicken blood (of the software type).

Now, I'm finally coming to the point. What can you tell me about the possibility of implementing the 16-transition type of pre-frame sync on the WD-1933 which you are using? Have you implemented it and how? I would appreciate your inputs as soon as possible.

I would like to be able to write pre-frame sync into the Level 1 document. Eric Scace, K3NA advises that this subject belongs to level 1 (not 2) because it deals with extra-frame signals which are there to make the modems work.

Bob and I realize that this demod is not the simplest one that could be used to copy the satellite. We are also working on a simplified PLL-type suboptimal MSK demod and will let you know more about this one when it is further along.

73, Paul, W4RI

FILE QST.83.01.31.0.N6ECT

To : All Interested Packeteers
From: Curtis, N6ECT
Date: January 31, 1983

Subject: Year Report on CALLS.LOGGED 1982

	CALLS LOGGED PACKET RADIO	CALLS LOGGED TELEPHONE	CALLS LOGGED TOTAL
+++++			
JAN	268	133	401
FEB	274	62	336
MAR	252	82	334
APR	109	88	197
MAY	174	131	305
JUN	110	89	199
JUL	94	83	177
AUG	48	69	117
SEP	41	22	63
OCT	56	52	108
NOV	49	59	108
DEC	47	62	109

YEAR	1522	932	2454

The following stations/individuals participated:

WB2GDQ	KA6NAN	WA6SLF	WA6RZW	WB2CAM	KA6ETJ	WB6SDE	WA6JFZ	WA6AZP
WB6KTN	WB2HUT	WB6HJP	KA2BQE	VE7CYD	WB6WBK	WB6YMH	AA4KB	N6ECT
W6RAW	W6JHJ	K6VCO	N6HRN	KB6WP	KA1AS	KD6SU	N6CKV	N6GJH
KD6LI	N6FQR	N6BOH	N6FTZ	K6HWJ	W60CP	W6LLO	W6FFC	K6HSV
W9DHK	KA6M	KA9Q	W6CB	AD7I	KO6R	KN6W	W6BB	NJ6A
W6XN	GNU							

FILE QST.83.01.31.0.W4RI

To : Den Connors, KD2S
Hank Magnuski, KA6M

Info : Doug Lockhart, VE7APU
John Spraggs, VE7ADE
Tom Clark, W3IWI

Subject: Level 1 Considerations

Yesterday, I sent you (except for W3IWI) a message discussing pre-frame sync in order to solicit what you know about the feasibility of implementing two octets of bit reversals on the WD-1933 ahead of the initial flag of the frame.

No sooner was that dispatched when the incoming mail brought a manuscript for QEX from Karl Meinzer, DJ4ZC. In it he makes a case for 4 (rather than 2) octets of pre-frame sync. He also has a number of other well-received points which I will certainly incorporate in the Level 1 document to the extent possible. So, Karl's input is timely and much appreciated.

Karl's article doesn't change my question (can the WD-1933 produce reversal-type pre-frame sync, albeit 2 or 4 octets). However, I thought that you'd like to have benefit of Karl's thoughts at this time. So attached is a preview of what will be

published in QEX 14 (March) and not for reproduction until it appears in QEX: (I hope that I can also include Den's bibliography on msk in the same issue so it'll be a good issue for the March 19 packet conference.)

73, Paul, W4RI

(Attachment)

Packet Radio and Radiocommunication Requirements

By Karl Meinzer, DJ4ZC

Introduction

The recent adoption of the AX.25 \1} standard for radio-amateur packet radio has been a significant milestone towards a more widespread use of digital communication. So far efforts concentrated on the digital and logical requirements of this new form of communication. Adopting essentially the existing X.25 standard has some potential problems, though, when facing the realities of Amateur Radio. The X.25 standard had been designed for the "good" communication links normally used in the commercial environment. With amateur signals often fading into the noise and with QRM being quite frequent, the AX.25 standard may be less than ideal.

Sync-Vector Requirements

When the author developed the AMSAT Phase III digital communication techniques, a blocked format was found to present the best overall properties. This means that each valid transmission consists of a block of constant length (512 bytes with Phase III), and in between these blocks some idle characters are being sent. The satellite uses synchronous transmission; this means that no start and stop bits are used and that the data stream is continuous. There are a number of ways to recover the bit clock; in the case of Phase III biphase encoding of the data was adopted to simplify the process on the ground.

Synchronous communication has many advantages over the older nonsynchronous forms. The data rate is effectively 20% higher. More important, though, is the possibility to use more modern modulation techniques having considerably better weak-signal performance.

Because of the continuous nature of the data stream it becomes necessary to identify the beginning of the individual bytes and the entire block of valid data. When the signal/noise ratio is good and data errors are an infrequent occurrence, the recognition of one particular byte in the data stream usually is sufficient to get this information. Most of the ICs commercially available for synchronous communication thus provide the capability for recognizing 1 or 2 bytes as the so-called "sync vector"; and the X.25 standard also uses the "flag" byte for this purpose.

If the link performance may get very poor temporarily, e.g., in space communication or with Amateur Radio, one or two bytes for synchronization are not adequate. In this environment it makes sense to require that sync (the beginning of a block) is declared only if the block start is positively identified. If the receiver is just getting noise, the modem will output random data, and the probability of this random data declaring "sync" should be reasonably small to prevent this false sync masking the real sync vector possibly coming a little later. (This assumes that no squelch can be utilized in the receiver -- there are no practical ways to design an effective squelch with the better communication modes requiring low signal levels.)

The time between declaration of false sync on random data is $t = 2^n / \text{data rate}$, n being the length of the sync vector in bits. With $n = 8$ every 256 bits (about once every 1/4 second at 1000 bit/s) a false sync is declared. Even with a sync vector of 16 bits long (2 bytes) about once per minute a false sync will be "recognized." Because of this problem AMSAT adopted a 4-byte sync vector for the Phase III satellites. NASA also uses 4-byte vectors in their telemetry transmission. With the 4-byte vector the probability of false sync is so low that only every 50 days or so a false sync will occur. Since at the end of the block a CRC normally will be used to identify errors, this performance is quite satisfactory.

Modulation Formats

Most high-performance data transmission systems use some form of phase-shift keying (psk) because these modulation systems offer excellent E_b/N_0 performance for vhf and uhf data transmission. The receiver for these formats must reconstruct carrier and bit-rate phase and frequency for proper operation. This reference information then is used by the circuitry to demodulate the received data.

It should be noted that the quality (absence of phase jitter) of the reconstructed carrier determines if the theoretical predictions as to the E_b/N_0 performance can be obtained. Without going into the mathematics it can be stated here that for 2-phase modulation formats the effective two-sided bandwidth of the carrier-recovery PLL should not exceed the data rate/4. With 4-phase techniques (e.g., qpsk or msk) this PLL bandwidth must be reduced to the data rate/100. (With 2-phase systems the signal degradation is proportional to the cosine of the phase error; with 4-phase systems the degradation results from quadrature-channel crosstalk proportional to the sine of the phase error.)

The loop bandwidth determines the time required for the receiver PLL to become locked after the transmitter is keyed on. A very careful PLL design is necessary in order to make this time to lock short enough so that the transmitter on time is not governed by receiver acquisition requirements rather than the data content of the packets. In the design of the Phase III

modem (the so-called AFDEM) a 3-level search strategy was necessary to accomplish a time to lock of 5 seconds (with a 5-kHz search range and two-sided loop bandwidth of 100 Hz).

With coded transmission the acquisition time becomes even more constraining. This situation clearly favors 2-phase PSK (which also is simpler to implement) because the total amount of data transmitted in a given time may be larger even if the data rate is cut in half because the receiver lock-up time is so much shorter.

Formats for Coded Transmission

Although not known very much to amateurs, there are simple ways to considerably improve the weak-signal performance over the capabilities offered by straight transmission of data. These methods make use of the prediction of the communication theory of Shannon that the performance may be improved by redundancy, i.e., transmitting more information than just the desired data and using this information to remove errors.

Typically the data stream transmitted is doubled (or also sometimes tripled) by producing two symbols from each data bit using a simple shift register and exclusive-OR gate arrangement (a so-called convolutional coder). This operation also can be performed entirely by software.

Recovering the data from the symbols is the more complex part of the operation. There are two different methods in widespread use. The so-called Viterbi decoding requires special and fairly complex hardware and is used mostly with continuous data. For amateur use this technique is probably too complex. For blocked data there is another technique called sequential or "Fano" decoding. This decoder can be implemented by software and requires little or no change in the receiving hardware.

AMSAT-DL implemented Fano decoders on the Radio Shack TRS-80 (tm) Model I and the Color Computer as a backup for the Phase III satellite -- should something make the links poorer than calculated. These decoders are fast enough to decode a few-hundred bits/s in real time.

The performance of these decoders is such that they can recover a block of data if the total number of symbol errors does not exceed 3 to 3.5%. This means that an E_b/N_0 of 2 to 3 dB at the symbol rate is sufficient, while normally 10 to 11 dB E_b/N_0 is required for acceptable performance. Because the data rate is only 1/2, there is a net gain of about 5 dB - and all that is required is a short program in the computer which is needed anyway.

In view of this situation it would be a good idea not to preclude the use of coded transmission for packet radio. These considerations should be taken into account:

- An even longer sync vector is needed to allow a probabilistic recognition of this vector. AMSAT-DL uses an 8-byte vector - if 60 of the 64 bits are correct, symbol sync is declared.
- Differential coding (which normally is used with psk to eliminate the sign ambiguity of the carrier) cannot be used. For this reason the sync-recognition program also looks for the inverse sync vector and sets a sign flag accordingly.
- A CRC is not needed at the end of the block. Either the decoder can decode the received block - there is a negligible probability of error - or the decoder will declare the block as undecodable in the time allocated for decoding.

Conclusions

Some of the properties of the advanced synchronous communication techniques giving the best-known weak-signal performance were discussed. In order not to preclude the use of these techniques in the emerging amateur-packet-radio systems it is recommended that standards with the following properties be adopted:

- Sufficiently long sync vectors (4 bytes for uncoded, 8 bytes for coded transmission) should be adopted. The AMSAT vectors allow both simple hardware and software recognition.
- A fixed block length should be adopted to make the block end uniquely identifiable even in the case of bad error rates. This also allows making the blocks entirely transparent, i.e., arbitrary bytes (like binary data) may be included in the data of the block.
- Synchronous techniques should be recommended using efficient modulation techniques. Four-phase techniques (like qpsk or msk) should be used for data rates in excess of 10 kbit/s only because otherwise the carrier-recovery loop bandwidth becomes too narrow and the time to lock becomes excessive.

The author hopes that these hints based on the experience gathered during the development of the digital communication system of the AMSAT Phase III satellites will help to implement state-of-the-art communication technology with amateur packet radio. The price for this is only the understanding of the issues - realizing these ideas for the most part requires only appropriate software and is well within the reach of amateurs due to the widespread availability of low-cost microcomputers.

Reference

\1} Magnuski, "Agreement on Packet Radio Standards," QEX 12 October 1982 and ASR.

FILE QST.83.02.01.0.KA6M

To: Paul Rinaldo
Fm: H Magnuski, KA6M

Sj: HDLC Sync-vectors and Pre-frame sync

Comments on Karl's article --

1. Four bytes of pre-frame sync is an entirely different thing from four bytes of sync vector. What Karl is advocating, in effect, is that the HDLC chip must receive four contiguous flags before it decides that a frame is truly arriving. I don't know of any way to make our HDLC chips go into start-of-frame mode on more than one flag.
2. If the data link is so bad that a lot of false syncing is expected, then I think we're going to have some serious problems getting any data through at all. If the receiver has started receiving a false packet at the very beginning of a transmission, only one properly received flag is required to scratch the false packet and start anew. There is no chance of missing a flag and its subsequent packet because you happen to be in the wrong byte-sync at the time the flag flies by.
3. Preframe sync of a zero pattern can technically cause false packets to be detected. The pattern FLAG-ZERO FILL-ZERO FILL- ... -FLAG will be interpreted as a frame with a bad FCS by most hardware. I know, as my repeater was tripping up on the packet stream being sent out by the VADCG TNC in the early days of trying to make the two talk to each other. Filler FLAGS do not cause this problem (which is small but annoying).
4. HDLC inherently provides for sending transparent data, and fixed block coding offers absolutely no advantage in that area.
5. I don't recall any agreement to adopt X.25 or AX.25. The use of those terms to describe what we have adopted is misleading.

73, Hank

FILE QST.83.02.06.0.VE7APU

To : Paul Rinaldo, W4RI
Info : John Spraggs, VE7ADE
 : Hank Magnuski, KA6M
 : Den Connors, KD2S/Lyle Johnson, WA7GXD

Subject: Pre-frame sync, etc.

Dear Paul,

To my knowledge, the 8273 is the only one of the three chips you are concerned with that automatically generates the pre-frame

synchronization transitions. This feature is very convenient. On the other hand, all three of the chips offer direct control of the bit stream being sent out in some form or another. This direct control of the bit stream is not very convenient to use mainly because it requires extra software to drive. I would expect that both the WD-1933 and the Zilog 8530 would be able to simulate the automatic operation of the Intel 8273 with appropriate software.

All the chips operate in flag stream mode as well so they all can be made to send any number of flags before the block. The easiest way to do that is by adjusting the clear to send delay on the modem. The 16 reversals is more efficient because it gives the modem more transitions to synchronize on. With bit-oriented protocols, as we are using, the modem only has to do bit synchronization - not byte synchronization. The synchronization that Karl is referring to in his article is 'byte' synchronization which the chips we are doing performs automatically. Karl is confused. He thinks that the 'flag' being used in bit oriented protocols is a 'sync vector' that the modem needs to see in order to provide correct clocking to the digital circuitry and so he has become very concerned over the identification of this particular bit pattern. He also appears to think that this pattern might occur accidentally in the data stream and cause trouble. Neither of these is the case. With bit-oriented protocols, the only thing the modem need be concerned with is providing a clock tied to the data transitions. The fact that a 'flag' may occur with random garbage coming in on the data line is of no concern to us since the 8273 and others will only give us a packet if it is bounded by flags at either end and has a valid CRC-16. The 'flag' bit string can never occur in the data no matter what random data we send out because the chip uses a bit-stuffing technique.

I am afraid that Karl's article will spread more confusion in any area where there is already plenty. His sections on 'Sync-vector requirements' and 'Formats for Coded Transmission' contain information which don't apply to X-25 or our system but because of his mention of the "flag" byte and X-25 in the section 'Sync-vector requirements' make it appear that it does. Furthermore, the mention of the adoption of AX.25 in the Introduction is incorrect and I strongly disagree with some of the conclusions in the section titled, 'Conclusions'. He has a right to his opinion however.

In reference to Karl Meinzer's article, I agree 100% with Hank's 5 itemized comments and I have some additional comments.

1. I fought the battle of fixed length versus variable length packets back in 1979. Karl's conclusion that we should adopt a fixed block length for packets seems to fly in the face of all the progress we have made to date. While Karl's system for control of the satellite may have been very effective the fact is that in a general use data communications network we usually do not have 512 bytes (the number Karl used) to send at a time. Of

what use is a 512 byte packet when we only want to send a carriage return character? We have already solved the problem of data transparency as Hank has pointed out. I don't want to review the entire issue here but I will make the following statement albeit unsubstantiated in this note: There are both disadvantages and advantages to both fixed and variable length packets but for the general use Amateur Packet Radio network the advantages of variable length packets outweigh those of fixed length packets.

2. The use of Forward Error Correction (FEC). There are three types of communication paths that Amateurs will likely be using for packet communication in the future, namely VHF/UHF, HF and Satellite. My best guess is that as the future unfolds the VHF/UHF terrestrial usage will predominate.

A. VHF/UHF paths are characterized usually by having either a good signal or no usable signal at all. In this environment FEC requires additional overhead and provides no benefit whatsoever. A retransmission scheme for error correction is being used now which has proved to be efficient. The chips and equipment that we are using now do not have any provision for FEC in any case.

B. HF paths used by Amateurs are so subject to disruption that I expect that they will never be widely used for communications requiring data integrity. It is true that commercially, HF channels are used for this purpose but the techniques used commercially are normally not available for the Amateur for both technical reasons and also because Amateur regulations do not permit their use. In addition to the unreliable channels, Amateur channels are not protected and so even when conditions are optimal, communications may be disrupted by QRM. Commercial usage is usually not troubled by this latter problem. In this environment FEC would only be useful when the propagation conditions were right and there was no QRM on the channel. As Karl says FEC doubles or triples the overhead and so it increases the chance of the packet being hit by QRM and Rayleigh fading. It is also only effective when a maximum of about 2 to 3 percent of the bits are lost. Note that it always has to be backed up by a retransmission system in any case to recover packets that the FEC system didn't handle. Let's look at the situations when FEC is of no use:

When signals are so weak that no communication is possible.

When a packet comes through perfectly with no errors.

When fading wipes out more than 3% of the packet.

When QRM wipes out more than 3% of the packet.

With a system using retransmissions alone, the same packet could be transmitted 2 or 3 times in the period that it would take the FEC packet. I would suggest using shorter packets for the HF channels rather than FEC. The AMTOR system uses this method on HF. When the channel is clear, the retransmission system will outperform the FEC system.

C. Satellite paths are more like the VHF/UHF situation where there is a solid signal or no signal, but the signal is not

quite as reliable. Retransmissions are likely to be required because of packet collisions but FEC would not help here because a collision would likely wipe out more than 3% of a packet and FEC would automatically cause an overhead increase of 100 to 200% on every packet.

I don't know much about the AX-25 protocol yet but I am awaiting your Level 1 document. I am a little concerned over the name of the standard because it sounds a little like the X-25 commercial standard which I studied to see if it was applicable to the Amateur Radio Packet environment in 1979 as well. I concluded that it was unsuitable but had a few good ideas in it. I don't think that any standard for Amateur Radio could come from the X-25 protocol. Even if some ideas come from the protocol, it will have to be quite a bit different from X-25 and so shouldn't be named after it. I think more and better ideas are found in the DoD Transmission Control Protocol document that you provided me than in X-25.

Karl's statement about the "... recent adoption of the AX.25 standard for radio-amateur packet radio..." is quite a bit premature in my opinion. I have not had an opportunity yet to review it and I would not like to see any protocol adopted until it was implemented first - even my own proposal which was published in 1981. There are many problems with protocols which only show up after they are tried out in real conditions. To my knowledge the only agreement made among the various groups was to use the HDLC/SDLC frame and FCS, bit oriented protocols and variable length packets. As yet, there has been no agreement as to the layout of the data contained in the frame or in the address or even the control field to my knowledge.

73, Doug, VE7APU/3

FILE QST.83.02.08.0.n6fqr

To: Packeteers
From: Bill Danielson, N6FQR
Subject: Downloading of VADCG board

I have modified my VADCG board to be downloadable. The modification is upward compatible in the software sense, that is, the current TIP/LIPM software HEX files will run as is. The board contains 16K bytes of RAM usable for program/data.

I also added a counter that interrupts the CPU every 1/1200 of a second. To maintain compatibility with the current VADCG board, this interrupt is hardware disabled when the board is booted and must be enabled by an OUTPUT instruction. The idea here was to use it to do such things as force out data in host mode, etc.

Downloading works as follows: When booted the EPROM resides at location 0000-07FF and there is RAM at 8000-87FF. The rest of the RAM resides in its normal locations, that is, 0800-3FFF. The hardware is set up so that if the VADCG issues a certain OUTPUT

instruction, the RAM and EPROM exchange places. From then on, the address space is:

0000 - 3FFF -- 16K of RAM (consisting of 8 6116s)

8000 - 87FF -- 2K EPROM for downloading and future use (2716)

Since the current TIP/LIPM software all executes in locations 0-1FFF, the board maintains compatibility with current software.

The format of the data to be downloaded is Intel Hex format. The file is currently sent over the RS-232-C port. The downloading protocol could be easily changed to make it use any format that was desired. One could even foresee downloading via the network. This would allow this modification to be useful to those who do not currently own a computer to do the downloading.

I will try to have more details, schematics, etc, ready by the next meeting. Briefly, you throw away your 2708s and 2114s (anyone need some to build their board?) and replace them with a 2716 and 8 6116s. 3 additional MSI LS TTL chips are needed (LS74, LS153, and LS193). The only part of the modification that I am concerned about is the use of the OUTPUT ports. I'd like to talk to an 8085 hardware expert about this at the next meeting.

BRD N6FQR

FILE QST.83.02.13.0.W4RI

To : All Packeteers
From : Paul Rinaldo, W4RI
Subject: FCC Approves AMTOR

Here is the verbatim text of the FCC order authorizing AMTOR. Section 97.69, Digital communications, has been rewritten apparently to clean up the wording. It appears to me that there is a problem in the new paragraph (a)(2) which states that the shift shall be less than 900 Hz. That restriction, while perhaps a reasonable one below 28 MHz, is impractical for sending speeds of 19.6 and 56 kilobauds which are specified speed limits for Baudot, ASCII and AMTOR in paragraph (a)(1). Any fsk modulation scheme that I'm aware of requires a shift (in Hz) of at least 1/2 the data signaling rate (in bauds) for so-called minimum-shift keying (msk). A shift of 83.333% of the baud rate is used in modems such as the Bell 202, and typical PLL demod chips are optimized for this relative shift.

So that leaves us with the fact that (I think) everyone on packet radio in the U.S. (and parts of Canada) uses Bell 202-compatible modems which have 1000-Hz shift. One can read the old paragraph (c) which allows any digital code over 50 MHz and read into it that what we are (virtually all) doing on 2 meters is legal if we regard packetized ASCII as "any digital code" rather than ASCII. Paragraph (c), which was printed in the October 1983 AMRAD Newsletter, restricts only bandwidths not shift nor speed

for "any digital code" above 50 MHz.

But below 50 MHz, we can't use "any digital code," and can't use more than 900-Hz shift for Baudot, ASCII or AMTOR. That interpretation would mean that the new wording says that it's now illegal to use a Bell 202 modem with 1000-Hz shift below 50 MHz. A few of us have been on 28-MHz packet radio using Bell 202's for groundwave and skywave tests.

To add to the confusion, we are now forced to interpret packet radio (as we are practicing it in the U.S.) as "ASCII" below 50 MHz and as "any digital code" above 50 MHz in order to obey the rules as now written.

So, I believe that the 900-Hz shift restriction to the three specified codes at the higher speeds may be inadvertent because as I understand the FCC's intent they were hoping to clean up the wording and make the same speed limits apply to all three specified codes. I have discussed this with Perry Williams, W1UED the ARRL Washington Coordinator. Perry suggested that I get in touch with the FCC on Monday, February 14 and see what can be done. (Due to the snow here, that may have to wait a day because Monday has been announced as a "liberal leave" day.) Perry will be here in Washington on Wednesday to discuss it further if necessary. If I can present the case properly, the FCC could issue an "errata" to ease/eliminate the problem caused by the new wording.

73, Paul, W4RI

Before the
Federal Communications Commission
Washington, DC 20554

PR
FCC 83-36
32687

In the Matter of)
Authorization of the digital code) RM-4122
"AMTOR" for use by stations in the)
Amateur Radio Service.

ORDER

Adopted: January 27, 1983 Released: February 8, 1983

By the Commission: Commissioner Sharp concurring in the result.

Introduction

1. The Commission has before it a petition for rule making, RM-4122, submitted by the American Radio Relay League, Inc. (the League) and received by the Commission on May 26, 1982. The petition requests "... that the Commission amend Section 97.69 of its Rules to permit transmission by amateurs of the digital teleprinter code specified in Recommendation No. 476-2 (1978) of the International Radio Consultative Committee (CCIR), known in the Amateur Radio Service as 'AMTOR,' in the amateur high-frequency bands." 1/ The petition describes AMTOR as "... an

automatic request-repeat radioteleprinter system ... developed for the commercial maritime service ..." (and commonly known by the trade name "Sitor" in that service).

2. The League's petition states that AMTOR has the inherent benefit of "... reliable, error-free copy at the receiving teleprinter, and the certainty of the sending operator that the data has been received correctly." A station utilizing the AMTOR code "... transmits data in blocks of three characters, pausing after each to obtain from the receiving station either an acknowledgement or instructions to re-send." According to the League, "The automatic 'handshaking' technique of AMTOR transmissions allows reliable communication even under marginal and fading high-frequency propagation conditions." The two digital codes currently authorized for use in the high-frequency bands, Baudot and ASCII, 2/ do not support this feature.

Discussion

3. In a recent action in the Commission's proceeding dealing with the use of additional digital codes in the Amateur Radio Service, the use of any code was authorized in all amateur frequency bands above 50 MHz. 3/ However, in the Notice of Proposed Rule Making in that proceeding 4/, the Commission did not propose to make such a blanket authorization for the frequencies below 50 MHz in consideration of our international obligations. The Commission, in that Notice, reiterated its concern, expressed in at least one prior proceeding, 5/ that the authorization of any and all codes, on frequencies where international propagation of radio signals is unavoidable, code be a violation of Article 41 of the International Telecommunication Union (ITU) Regulations. That article states, in part, that "... transmissions between amateur stations of different countries ... shall be in plain language." The Commission, therefore, is obligated to consider, on a case-by-case basis, whether a particular digital code is standardized sufficiently worldwide in order to be considered "plain language." Such finding was made in the proceeding in Docket 20777 when the use of ASCII was authorized.

4. As the League has carefully pointed out in its petition, AMTOR is an internationally recognized code recommendation for the commercial maritime mobile service. Because of this, we believe that it can clearly be characterized as "plain language." Accordingly, we are authorizing the use of the AMTOR code by amateur radio stations operating in the HF bands.

Conclusion

5. We find that good cause exists to dispense with the prior notice and comment procedure provisions of the Administrative Procedure Act (APA) as unnecessary in this proceeding since it is unlikely that any objections would be received in view of the obvious benefits which are being conferred. 6/ 7/ The APA's effective date requirements are also

not applicable to these rule amendments because they either relieve a restriction or are interpretative. 8/

6. Accordingly, IT IS ORDERED that, effective on the date of publication of this Order in the Federal Register, Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, IS AMENDED as set forth in the attached Appendix. IT IS FURTHER ORDERED that RM-4122 IS GRANTED. This action is taken pursuant to authority contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended. Further information on this matter may be obtained by contacting: Steve Lett, (202) 632-4964, Federal Communications Commission, Private Radio Bureau, Washington, DC 20554.

FEDERAL COMMUNICATIONS COMMISSION

William J. Tricarico
Secretary

Attachment: Appendix

1/ The high frequency (HF) bands are those bands between 3 and 30 MHz.

2/ Baudot is the common name for the International Telegraph Alphabet No. 2. ASCII (American Standard Code for Information Interchange) is defined by the American National Standards Institute (ANSI) Standard X3.4-1968.

3/ See Report and Order in PR Docket No. 81-699, 47 FR 42751, September 29, 1982.

4/ 46 FR 50993, October 16, 1981.

5/ See Third Report and Order in Docket 20777, 45 FR 8990, February 11, 1980.

6/ See 5 U.S.C. 553(b)(3)(B).

7/ Some of the other rule amendments in this action are interpretative and, therefore, exempt from the prior notice and comment provisions of 5 U.S.C. 553(b)(3)(A). These amendments merely codify our longstanding interpretation that stations operating on frequencies where international propagation is unavailable must not only use codes which are internationally recognizable but also must employ modulation techniques which enable the transmissions to be monitored. In this regard we are explicitly requiring that transmission of all digital codes specified by the Commission be made with frequency shifts of less than 900 hertz. They also clarify the Commission's requirement that radioteletypewriter operation be confined to the frequencies where F1 emissions are authorized.

8/ See 5 U.S.C. 553(d).

APPENDIX

Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, is amended as follows:

In Section 97.69, paragraphs aV and (b) are revised to read as follows:

97.69 Digital Communications.

(a) The use of the digital codes specified in paragraph (b) of this section is permitted on any amateur frequency where F1 is permitted, subject to the following requirements:

- (1) The sending speed shall not exceed the following:
 - (i) 300 baud on frequencies below 28 MHz;
 - (ii) 1200 baud on frequencies between 28 and 50 MHz;
 - (iii) 19.6 kilobaud on frequencies between 50 and 220 MHz;
 - (iv) 56 kilobaud on frequencies above 220 MHz.

(2) When type A2, F1 or F2 emissions are used, the radio or audio frequency shift (the difference between the frequency for the "mark" signal and that for the "space" signal), as appropriate, shall be less than 900 Hz.

(3) When type A2 or F2 emissions are used, the highest fundamental modulating frequency shall be less than 3000 Hz.

(b) Except as provided for in paragraph (c) of this section, only the following digital codes, as specified, may be used:

(1) The international Telegraph Alphabet Number 2 (commonly known as Baudot); provided that transmission shall consist of a single channel, five unit (start-stop) teleprinter code conforming to the International Telegraph Alphabet Number 2 with respect to all letters and numerals (including the slant sign or fraction bar); however, in the "figures" positions not utilized for numerals, special signals may be employed for the remote control of receiving printers, or for other purposes indicated in this section.

(2) The American Standard Code for Information Interchange (commonly known as ASCII); provided that the code shall conform to the American Standard Code for Information Interchange as defined in American National Standards Institute (ANSI) Standard X3.4-1968.

(3) The international Radio Consultative Committee (CCIR) Recommendation 476-2 (commonly known as AMTOR); provided that the code, baud rate and emission timing shall conform to the specifications of CCIR 476-2 (1978) Mode A or Mode B.

FILE QST.83.02.14.0.KA6M

To: All Packeteers
Fm: Hank Magnuski, KA6M
Dt: 14 Feb 83
Sj: Packet Meeting for February

Strategies for Level 3 Networking in Northern California

Now that the Level 2 Protocol issues have been resolved (and equipment is running, see below) it's time to focus our attention on the next protocol level and come to some kind of group consensus about which way we want to go. I will present some general outlines of the issues and hope to have some feedback from the group. Implementation of a Level 3 protocol here would be a giant step forward for packet radio.

Final planning for the National Packet Conference at the Faire will also take place.

Other News:

The code in the KA6M/R repeater has been revised to accept the new national standards, and it is now back on the air. Bill Danielson and I have had the first QSO using this new code. Thanks to K6EER for the site for now. The hex code for the VADCG beta test version of the protocol is on the computer.

Thanks to the help of Stu Neblett, KA6M** now has a brand new roof mounted antenna. Please send me any comments you might have about signal strength or performance. It's a four element beam pointed at Woody. Should we go to an omni-directional antenna?

See you at the meeting!

FILE QST.83.02.14.0.W3IWI

From: TCLARK
To: pacsat
Subj: TAPR Beta Testing
Fellow BETAers:

A few TAPR TNC related items:

(1) Suggested addition. Put 4.7k to 10k pull-up resistors on J2 pins 7,14,15 to +12vdc to force DSR, CTS and DCD true even if nothing is connected.

(2) If you get any reports of excessive 5vdc ripple or overheating xfmr's, the xfmr connector is probably plugged in backwards. (Yes, I goofed here. NO damage except to my ego).

(3) I can't seem to get PERM to change the NOVRAM. If I boot from

ROM default at 300 baud, then diddle some parameters (MYCALL, ABAUD, etc), the parameters take fine by throwing S1 and typing RESET. But PERM does not save them, so I have to go thru the 300 baud boot each and every time. Any ideas?

(4) Has anyone got a fix for the reset problem? On power-up the TNC is catatonic until the S3 reset switch is thrown. The 100uf cap should make a clean POC, but doesn't do the trick.

(5) Any ideas when a software patch to solve the PID bug will be issued? Will it necessitate major surgery or can it be easily patched locally. I'd like to get the locals off on the right foot here.

(6) Hank sez that he has TIP/LIP05 for VADG AX.25 in Beta-testing phase now. How soon can we put VADG to rest totally?

(7) For those of you wondering about how wide-spread we are, the AMSAT Beta sites include boards (2 each) for ZS, ZL and JA. Who will get the first packet WAC? I offer the challenge that I currently am leading the WAS tally with 3 (MD,VA,TX). Any challengers? Who (besides N5AHD and I) are set and raring to go on 10 meters?

tom

FILE QST.83.02.21.0.W4RI

To : Hank Magnuski, KA6M
Lyle Johnson, WA7GXD
Info : Doug Lockhart, VE7APU
From : Paul Rinaldo, W4RI
Subject: Preframe Sync

Thank you, Hank and Doug, for the previous input that you gave me on this subject. I have gone over it several times with Bob Watson with sufficient time for him to reflect on the alternatives.

I told him that of the three protocol controller chips we are using, only the Intel 8273 (not the WD-1933 nor the Zilog 8530) can straightforwardly generate 00 hex or 16-reversal preframe sync. However, all will generate any number of flags. Thus, would a (say) NRZI-encoded two-flag preamble be enough for reliable sync over amateur circuits?

His answer today was "negative." He says that about 10 transitions are needed. That seems to leave us with the following choices:

(1) Forget about requiring any preframe sync.

(I don't like this one at all because we'd have a high probability of miscopying the first few characters until sync is acquired. For less-than-perfect circuits, we can miss the flag

without preframe sync because of improper bit timing. Therefore, not using preframe sync will relegate our protocol chips to operation on only nearly perfect circuits, such as the current 2-meter fm packet operations. Taking the 8273 for example, the DPLL will lock immediately on a perfect signal. If there is some noise on the circuit, even at reasonable bit error rates that will let \say} 50% or more of the attempted packets through, the DPLL may require some transitions to achieve optimal timing. The number varies according to where the DPLL initially samples within the RxD data cell. As wars are fought on the edges of two maps, it is possible that, every 32 \first} frames or so, the DPLL could sample on the edge of the data cell. That places the sample at the edge of quadrants A1 and A2, which means that the DPLL needs typically 9 counts to move the sample pulse to the center of the data cell. So, we can conclude that depending on S/N and its initial sampling point within the data cell, the chip needs 1 to 9 transitions, to lock its DPLL close enough to the center of the data cell to achieve optimal performance.)

(2) Send an agreed preframe sync pattern.

(The standard would say that the sending station must send the agreed pattern ahead of all packets. That would permit the DPLL to achieve bit synchronization before the flag character is received and thereby minimize the chance of misreading the flag. That would also permit flag recognition even when the S/N is poor.)

(a) Send 6 preframe flags.

(As each NRZI-encoded flag provides only 2 transitions, about 6 preframe flags are needed to produce the next increment beyond the minimum of 10 transitions. That's 48 bits of overhead! It's not out of the question but is simply inelegant to send 48 bits when only something more than 10 transitions are needed.)

(b) Send 16 reversals.

(This provides more than 10 transitions and does so in only 16 bit intervals, making for low additional overhead.)

Below are choices on how to generate 16 revs:

((1)) Generate it in the TNC/PAD.

(This is possible in the 8273. One can hope that the TAPR TNC TNC with its 1933 and the AMRAD PAD with its 8530 can produce 16 revs with appropriate software.)

((2)) Generate it in the (modem) modulator.

(Sixteen reversals can be generated by one or two chips added to our modulator design which is nearing completion. This seems to be a workable solution for the more difficult circuit applications \satellite, hf and long-haul vhf/uhf} or any time

when everyone will be pretty much forced into using newly designed optimal demodulators to get good results. People might fight adding this feature to already-designed modems \Bell 202s all over creation, recently-introduced TAPR TNCs with on-board XR modem\ which could work on the above circuits when signals are good. There may be a logical rationale out of this mess, however. We've already much agreed not to use Bell 202 modems \and the TAPR XR modem falls in this category\ on the satellite. So when you logically rule out everything that Bell 202 modems should not be used for, you are left with only our present type of application: i.e., for local-area applications where afsk over 2-meter fm is used. For afsk on fm, we can live without preframe sync. But if you generate it, nothing is harmed, and it can do some good when the circuit is a bit noisy.)

Those are the apparent options. Here are my tentative conclusions:

We should standardize, as soon as possible, on always sending 16 reversals of preframe sync.

Generating preframe sync on the modem is possible. However, the mixture that we will have of existing and (yet-to-be-produced) modems makes this a nonuniversal, and therefore an undesirable, solution.

It is desirable to generate 16-reversal preframe sync on the TNC/PAD (not the modem).

That leaves us with:

- (a) the fact that the 8273 is already happily generating preframe sync,
- (b) a belief that the 8530 can be tricked into doing it, and
- (c) a problem getting the 1933 to do it.

I'd appreciate any comments, particularly any thoughts on whether anyone can think of a way to make the 1933 generate preframe reversals.

73, Paul, W4RI

FILE QST.83.02.21.0.NK6K

From: HPRICE
To: PACSAT
Subj: Some thoughts on PACSAT software

Although there is little here that will directly effect initial hardware design, I think it would be a good idea to start getting a picture of what it is that all the hardware is up there for. The purpose of this document is to set down some ideas about the

part of the PACSAT software not directly associated with spacecraft management and control. For lack of a better name, I'm calling it PACMMS for PACSAT Message Management System. Someone suggest a better one, please. Although parts of this document are written as if specific design decisions have been, of course they have not been. It is simply easier to write that way. What is presented here is a set of possible solutions to a list of suggested goals.

Harold Price, NK6K

As a starting point, the following assumptions are made:

- 1) A separate computer is providing spacecraft basic control and is maintaining a separate control link to the ground.
- 2) Large on board memory is available for bulk data storage.
- 3) A software upload capability exists, at least 16k of program memory is available.

In the main, PACMMS should be viewed as an integrated software system with components on PACSAT and on the ground that supplies a set of services to a user. A short summary of end user services is presented below:

- o Mailbox. Mail messages are stored by PACMMS for later retrieval.
- o File storage. Files may be stored on pacsat for later retrieval. Mail messages have a specific form and structure, files do not.
- o Store and forward packet repeater.
- o Real-time network communications node, i.e., a smart digipeater.
- o Secondary telemetry path.
- o Support environment for onboard "applications" software, e.g. data gathering and reduction.

The following are more detailed descriptions of some of the elements of PACMMS and should be viewed as goals to shoot for.

PACMMS

The satellite resident portion of PACMMS should be divided into to distinct parts, the "operating system" and the "application

program". The operating system provides a set of services to the application, mainly in the areas of memory management and IO control. The operating system includes the software necessary to control the flow of data between PACMMS and ground stations, PACMMS and the control computer, PACMMS and the large memory.

The major advantage of this split is that the application software, the "bulletin board" system, can be designed to interface with a set of virtual devices. Checkout and testing can be done on a variety of ground based computer systems with floppy disk simulating the large onboard memory. As the inevitable hardware changes occur only the low level operating system routines will have to be changed.

PACMMS must also be a multiuser system. Several users can be "Logged on" to PACMMS at any time. Each must have a separate context area maintained, both at the protocol level and at the application level. Here again the operating system concept will be useful. As multiple users access multiple messages and files, standard OPEN/CLOSE/READ/WRITE operating system services will help solve multiple access and concurrency problems.

Mailbox.

PACMMS will offer an electronic mail service. Minimum attributes of mail messages would be from-address, to-address, creation date, title, and n lines of text. A minimal security mechanism should be provided to protect against accidental/malicious deletion of messages. Addresses should be callsign based. A mechanism for purging old messages should be provided.

Files.

Files are sent to PACSAT and stored for later retrieval. Files, unlike messages, have no internal structure forced on them by PACMMS. Files have names, creation dates, and the same level of security as is provided to messages. Files can also be created by PACMMS for its own use, e.g., for the storage of telemetry. Other uses for files include storage of PACMMS application software, raw data to be transferred among ground stations, new software for ground station control ready to be burned into ROM.

Store and forward.

PACMMS stores packets received from ground stations and sends them thru the downlink when requested by the addressed ground station. This differs from messages and files in the PACMMS stores the packets without attempting to use the data in the packets. PACMMS acts as a delayed repeater, except that packets are acknowledged by PACMMS when sent and received. This allows ground stations to communicate with each other in a higher level protocol than PACMMS is aware of without forcing the constraints of messages and files.

Direct ground station link thru PACMMS.

PACMMS acts as a node in a local area network. Ground stations are connected to each other thru the network in real-time.

Telemetry

PACMMS supplies telemetry to the control unit and receives telemetry from the control unit for storage in files or immediate transmission on the data link. PACMMS will supply the ability to send data on the downlink in a broadcast mode, i.e. not to any specific ground station.

Ground stations

PACMMS also lives on the ground. Commands to PACMMS will be parsed on the ground to reduce comm-link requirements. A token language to communicate with satellite resident PACMMS will be developed. PACMMS will be optimized to work with its own ground software, but some less robust interface should be provided to those wishing to develop their own ground software. Access via the simpler interface will not be permitted to adversely affect users of the full ground station software however.

Data compression.

PACMMS ground stations will compress data before transmission and decompress during reception to reduce comm-link loading. A compression standard must be agreed upon and added to the protocol definition. The standard compression must be used when sending commands to PACMMS but any method may be used for data destined for files or store and forward packets. Control and address fields in packets should not be compressed.

Security

PACMMS will provide password security for messages and files. Options include password required to LIST/READ and password required to delete. This will guard against accidental deletion and supply protection against malicious deletion from all but those ground stations with can hear your uplink signal.

Capability must be provided for a "system administrator" to delete messages and files regardless of password protections. One solution is to require that privileged commands be sent thru the control link to "unlock" the data base for a particular user.

Following is a first shot at breaking the PACMMS software down function areas for the purposes of phased development by different groups of developers. Each line item could be a separate task and in most cases can be broken down into several sub tasks.

1 Satellite resident

- 1.1 PACMMS operating system
 - 1.1.1 Control computer interface - Telemetry to and from, commands from
 - 1.1.2 Mass store system
 - 1.1.2.1 High level functions, OPEN/CLOSE/READ/WRITE
 - 1.1.2.2 Low level functions, get/put byte through serial interface.
 - 1.1.3 Ground station interface
 - 1.1.3.1 Data acquisition - modem control, RF control
 - 1.1.3.2 low level protocol handlers - collision control - channel scheduling
 - 1.1.3.3 High level protocol handlers - Path managementt.
 - 1.1.3.4 Network node functions not requiring message system control - store and forward?
- 1.2 Application software
 - 1.2.1 User management - logon, status. Maintain list of current active "users" (ground station in active communication).
 - 1.2.2 File system
 - 1.2.3 Mail system
 - 1.2.4 Administrative functions - mass store purge, reconfiguration of memory or data links - possibly via control link.
- 2 Ground station
 - 2.1 User interface software - user to PACMSS (1)
 - 2.2 Data link control - protocol drivers
 - 2.3 Ground station hardware control - RF, modem, low level IO.
 - 2.4 Interface to ground based networks - network node - gateway to PACSAT

FILE QST.83.02.21.0.WA7GXD

To: Paul Rinaldo
 CC: Hank Magnuski
 Re: 16-Transition Preframe Sync

Paul,

I read your message dated 21 Feb regarding the sync requirements for the various HDLC controllers being used, or planned for use, in Packet radio (I8273, WD1933, Z8530).

The WD specs are not as detailed as the Intel with regard to the number of transitions required to assure "lock" to the center of the bit field. However, while Intel does provide a nonstandard sync command to assure sync, it is unclear to some of us at present just how important it is to be sampling the data at the "exact" center of the bit.

We are currently sending frame sync headers during transmitter keyup time and have noticed no problems directly attributable to

a lack of ability in getting the DPLL sufficiently "locked" before address, control and data fields commence.

The 1933 is particularly unfriendly. The lack of direct user control over the state of the Tx Data pin forced us to redesign the Modem to allow on/off tone keying for CWID on the TAPR TNC. (I suppose the main claim to fame of this chip is that it is CHEAP -- \$14.)

The thought of having to modify 180 TNCs in the field is not pleasant. Several of us have discussed the pre-frame sync proposal, and have certain reservations.

1) What is the minimum useable keyup time before a user can safely send data? There are many parameters to consider here, including transmitter characteristics, receiver stabilization time, MODEM lockup time, repeater keyup (if used), etc.

It has been our limited experience so far that these are the big delays in getting a packet started. We currently fill this time with flag bytes, and have had no problems to date with lost data (causing retries) that have been traced to lack of HDLC DPLL sync.

2) How close to "dead center" in the bit time must the PLL sample the bit for data integrity? I expect this depends on the particular noise the system has in the communications link, but perhaps some Packeteer can model this and come to some conclusions. I am sure that more sophisticated Modems will appear in the future that use statistical sampling, or majority sampling, techniques to help noise tolerance, but that will have to wait...

To adopt a "standard" based on the particular requirements and/or shortcomings of a particular chip (the 8273 in this case), seems a bit strong. Some feel it may also be premature.

I don't know of anyone who has voiced an objection to the premise that preframe transitions are a good thing, but most of my contacts feel that adopting a "standard" is not good. Perhaps a "recommendation" is more in line, at least until some hard evidence can be assembled to support it as a need.

Thankyou for the opportunity to comment -- please keep us in the loop! There will be continued discussion on this question in the future here.

73's Lyle

FILE QST.83.02.21.0.kd2s

to all PACSAT team members
from Den, KD2S

The following is a partial list of people who are attending the Conceptual Design Milestone Meeting this weekend at Goddard Space Flight Center, or who cannot make it, but will be working on the team at least through the design phases. Some people may change their minds, and some unannounced people will undoubtedly show up.

From Tucson, I will represent the Tucson Amateur Packet Radio Corporation. Lyle Johnson WA7GXD, our new President, will be unable to attend the meetings, but will be able to provide both general digital engineering consulting and provide parts procurement services.

Phil Karn KA9Q will be providing the results of a large variety of systems concepts arguments, and will provide an enormous amount of engineering expertise on all aspects of the project.

Harold Price NK6K will be representing the Los Angeles packet group, and has been the primary pre-architect of the software structure for the entire PACSAT system. Dave Henderson KD4NL will not be attending, but will be working with Harold on lower level interfaces.

Chuck Murcko N2AOL will be coming down from Central New Jersey. He and KM2T are bringing an expertise in microprocessor hardware and RF design, and are interested in both the general design and in the ground station design.

Port Barlow is the secretary for the project, and will provide the group with support. He just happens to be very active in the TAPR packet Beta test, and will be involved in the interface of the PACSAT system with ground networks, along with John DuBois W1HDX.

Larry Keyser WA3ZIA will be handling the static CMOS RAM architecture for the satellite subsystem. Although Larry won't be at the meeting, the Ottawa group should be represented.

Steve Robinson W2FPY and Vern Riportella have been looking at the bubble memory subsystems, and will be appraising us of this technology. Steve is the head of R&D for AMSAT, and will therefore be involved in several aspects of the system design.

Tom Clark has been the primary protagonist of PACSAT from before the beginning. He will be involved in all design aspects of the system, and should be the softest shoulder to cry on, next to mine.

Jan King has been working on the initial system design of PACSAT, and will continue as one of the primary architects, along with Karl Meinzer, especially in the fields of modulation techniques, spacecraft design and launch acquisition. Jan will be involved in discussions with a number of external groups as the VP of

Engineering for AMSAT to smooth the way for PACSAT.

Martin Sweeting will be over from the UoSAT project office to provide the experience of the OSCAR 9 project, and to negotiate design efforts by the AMSAT/UK at Surrey team.

Miki Nakayama, the primary architect of JAMSAT's PACSAT project, will not be attending these meetings, but will be involved in separate meetings next month on the west coast with the PACSAT team.

Hank Magnuski KA6M will also not attend. Hank is the manager of the AMICON subsystem on the phase III bird, and will be at meetings next month also on the west coast.

Paul Rinaldo, W4RI, will be attending the Saturday meetings. Paul has been looking at modulation techniques for AMICON and HF linking, and is working on MSK modulation systems currently.

Bill Reed WDOETZ has been working on packet bulletin board systems, and will be looking at the higher-level protocols for the PACSAT software.

Several other members of AMSAT should be available for the meetings. Bob Diersing N5AHD may be attending, as will Jim Skoog. Some of the AMSAT locals to the Washington area will hopefully also attend.

The Volunteers in Technical Assistance (VITA) will be sending one or two representatives to see the goings-on, and to report on VITA's fund-raising efforts.

Finally, it is hoped that members of the Independent Space Research Group (ISRG) who will be at AMSAT HQ that weekend will also be able to participate.

While this list is not complete, it should provide an indication of the level of representation at the meetings this weekend. There are several other groups who have expressed an interest in assisting, but who will not be at this particular set of meetings. I'll be updating this list as the project progresses.

73, Den

The End (for now)

